S. Hrg. 98-713

STATE MINING AND MINERAL RESOURCES RESEARCH INSTITUTE PROGRAM

HEARING

BEFORE THE

SUBCOMMITTEE ON
ENERGY AND MINERAL RESOURCES

OF THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

SECOND SESSION

ON

S. 2186

A BILL TO ESTABLISH A STATE MINING AND MINERAL RESOURCES
RESEARCH INSTITUTE PROGRAM, AND FOR OTHER PURPOSES

FEBRUARY 10, 1984

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Committee on Energy and Natural Resources

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STATE MINING AND MINERAL RESOURCES RESEARCH INSTITUTE PROGRAM

FRIDAY, FEBRUARY 10, 1984

U.S. Senate,
Subcommittee on Energy and Mineral Resources,
Committee on Energy and Natural Resources,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:40 a.m., in room SD-366, Dirksen Office Building, Hon. John W. Warner, presiding.

Present: Senator Warner.

Also present: Robert L. Terrell, professional staff member; and Linda Mason, professional staff member for the minority.

OPENING STATEMENT OF HON. JOHN W. WARNER, A U.S. SENATOR FROM THE STATE OF VIRGINIA

Senator **Warner**. Good morning, ladies and gentlemen. The subcommittee will hear testimony today on S. 2186, a bill that I introduced on November 18, 1983, to reauthorize the mining and minerals resources research institutes.

Currently, S. 2186 has 28 cosponsors representing both sides of the political spectrum. I am encouraged by this show of support and hope that we will be able to move this bill through the Senate as expeditiously as possible.

State mining and mineral resources research institutes are now authorized under title III of the Surface Mining Control and Reclamation Act of 1977. This program is due to expire on May 15, 1984. This program provides Federal matching funds for qualified mining and minerals resources research institutes at one public college or university in each State which meets eligibility criteria established in the legislation. Each institute is directed to conduct research in mining and minerals resources and to train minerals engineers and scientists.

I will put the balance of my statement in the record along with statements and communications from other Senators, and the text of S. 2186.

[The material referred to above follows:]

OPENING STATEMENT
OF
SENATOR JOHN W. WARNER
BEFORE THE
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
9:30 A.M.
February 10, 1984

RE: Hearing on S. 2186 - A bill to establish a State mining and mineral resources research institute program, and for other purposes.

Good morning. The Subcommittee will hear testimony today on S. 2186 - a bill that I introduced on November 18, 1983 to authorize the Mining and Minerals Resource Research Institutes. Currently, S. 2186 has 28 co-sponsors representing both sides of the political spectrum. I am encouraged by this show of support and hope that we will be able to move this bill through the Senate as expeditiously as possible.

State mining and mineral resources institutes are now authorized under Title III of the Surface Mining Control and Reclamation Act of 1977. This program is due to expire on May 15, 1984. This program provides Federal matching funds for qualified mining and minerals resources research institutes at one public college or university in each state which meets eligibility criteria established in the legislation. Each institute is directed to conduct research in mining and minerals resources and to train minerals engineers and scientists.

During the last decade, there has been a steady decline in the numbers of mining and minerals-related engineers graduating from colleges and universities. As an engineering graduate, I recognize the strong national interest in encouraging our young people to choose science and engineering as careers.

The U.S. is competing in an international race for technological excellence, energy independence, and national security. The U.S. will not win that race without a strong foundation of superior knowledge and top personnel in mining and minerals. The research and training conducted at the institutes authorized under this bill will assist the U.S. mining industry in providing a solid foundation for our continued economic recovery and competitiveness in international trade.

The distinguished witnesses appearing before us today will share with this Subcommittee more specifics of the Institute Program and the necessity of continuing it.

I welcome the witnesses and look forward to their testimony.

STATEMENT OF SENATOR JAMES A. McCLURE
BEFORE THE
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
9:30 A.M.
FEBRUARY 10, 1984

RE: Hearing on S. 2186 - A bill to establish a state mining and mineral resources research institute program, and for other purposes.

Mr. Chairman, you are to be commended for holding this hearing today. As an ardent supporter of the State Mining and Mineral Resources and Research Institutes program currently authorized in Title III of Public Law 95-87, I was pleased to co-sponsor your bill, S. 2186, along with 27 of my colleagues in the Senate. As most of my colleagues are aware, the current Mineral Institutes program is due to expire in May of this year and so it is imperative that action on this bill be taken as expeditiously as possible.

While I recognize the importance of the Mineral Institutes program, I am concerned with the quality of research being conducted by the various colleges and universities authorized under the existing program. In recognizing that there were 31 such colleges and universities receiving funds, the Appropriations Committee of the House and Senate in Conference in the 1st Session of the 97th Congress directed the Department of the Interior to undertake a more focused effort in research conducted by these mineral research institutes and to submit a plan for bringing about a more consolidated approach to such research efforts. Subsequent to this directive, the Interior Department created 6 "Centers of Generic Mineral Technology" as a step toward research consolidation. These Centers were established for the purpose of concentrating attention on basic research needed to improve productivity in the mineral sector of the economy by investigating areas of innovative technology that promise to convert uneconomic resources to valuable reserves and/or to make more efficient use of domestic minerals. Each of these Centers would receive "seed-money" grants for use over a period of years to permit orderly initiation of research that would attract more and continuing industrial and institute participation. While this is a step in the right direction, I believe that more needs to be done to enhance the quality of research being conducted.

In closing, Mr. Chairman, I want to state for the record that the Mineral Institute program has made a significant contribution to reversing the trend of the 1960's when mining schools were closing down and state legislatures were abolishing long-standing Departments of Mining Engineering and Extractive Metallurgy, thus reducing the nation's capacity for graduate education and research in these areas. Because of the Mineral Institute program, several mining departments have been re-established, competent mineral engineering research faculty have been added to virtually all of the Institutes, many competent mineral engineers and scientists have been and are being trained and the caliber and quantity of research on mineral resource problems have increased notably. Meanwhile, additional support for the Mineral Institute program has come from the states, industry, and various federal agencies. In short, the program has been successful and should be continued at responsible funding levels.

STATEMENT OF SENATOR FRANK H. MURKOWSKI
BEFORE THE
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
COMMITTEE ON ENERGY AND NATURAL RESOURCES
ON
S. 2186
A BILL TO AUTHORIZE STATE MINING AND
MINERAL RESOURCES RESEARCH INSTITUTE PROGRAMS

February 10, 1984

I would like to commend the Chairman, Senator Warner, and Representative McNulty for their leadership in introducing this legislation. I am proud to have joined Senator Warner as an original cosponsor of S. 2186.

There are a number of steps we must take if we expect to reverse our dangerous dependence on foreign sources of minerals. I believe the maintenance of a domestic minerals industry must become the centerpiece of our minerals policy. It's obvious that we cannot hope to maintain a domestic minerals industry without a talented pool of qualified individuals who are well trained in all facets of mineral development and utilization. That is the true significance of this legislation.

I know that the members of this Subcommittee are well aware of my State's importance to the nation's long-term mineral security. Alaska is America's great storehouse of energy and critical "hard rock" minerals. The University of Alaska at Fairbanks is a leader among the universities which participate in the Mineral Resources Research Institute Program, due in part to its close proximity to several of Alaska's world-class mineral deposits.

I look forward to working with you, Mr. Chairman, and our colleagues in the House to move this measure toward enactment.

WILLIAM V ROTH JR DEL CHAIRMAN

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CHIEF COUNSEL AND STAFF DIRECTOR

March 2, 1984

The Honorable John W. Warner
Chairman
Subcommittee on Energy and Mineral Resources
308 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Senator Warner:

I am writing in reference to S. 2186, the bill which would reauthorize the Mining Research Institute program. As a cosponsor of this bill, I strongly support its passage. I do believe, however, that a minor change needs to be made in the eligibility criteria, so that none of the existing 31 institutes will be eliminated because of an oversight or a technicality.

In the bill, on the last page, criterion four of the eligibility criteria, requires that an eligible institute must be accredited in mining or minerals extraction by the Accreditation Board for Engineering and Technology, or have "evidence of equivalent institutional capability as determined by the Committee" (to be composed of individuals from government, universities, and industry). In short, without this accreditation, an institute's eligibility will be left to the discretion of this committee.

Although I agree that strict eligibility criteria should exist, I believe the language should be specific enough so that each institute will know at the beginning of the reauthorization period how its credentials will be judged. Eligibility should be defined better in the bill language, rather than left to the whims of a committee, the composition of which has yet to be determined.

Dr. James H. Swisher, of Southern Illinois University in Carbondale, in his testimony before the Senate subcommittee hearings on February 10, introduced an amendment which I believe eliminates unnecessary vagueness in the language, and provides a specific althernate criterion for those universities that do not have an accredited mining program. A copy of this amendment is enclosed.

Because they lack the above mentioned accreditation, many good schools (15 of the total 31 which house institutes) will be vulnerable if the present language is retained. In addition to SIUC's institute, institutes at universities such as Purdue, the University of California-Berkeley, Louisiana State University, the University of Kentucky, Ohio State University, the University of Oklahoma, the Massachusetts Institute of Technology, and Iowa State University, could possibly be eliminated. Even though these universities may lack an accredited program in mining engineering, they are strong in many of the other eligible research and training disciplines listed in the bill on page three, line 11 through 18. This amendment would enable institutes that have strong programs in one of these disciplines of mining or mineral resources to be assured of their continued existence.

I strongly recommend that you give this amendment your favorable consideration.

Sincerely,

Charles H. Percy
United States Senator

CHP:bej

Enclosure

Proposed Amendment to
HR 4214 and S. 2186

Section 10, "Eligibility Criteria" shall be amended to read as follows:

> The Committee shall determine the eligibility of a college or university to participate as a mining and mineral resources research institute under this act using criteria which include
>
> 1. no change
> 2. no change
> 3. no change
> 4. The presence of an engineering program in mining or minerals extraction that is accredited by the Accreditation Board for Engineering and Technology or evidence of substantial education programs in at least one of the disciplines in mining or mineral resources.

STATEMENT OF SENATOR
WILLIAM L. ARMSTRONG
BEFORE THE ENERGY AND MINERAL RESOURCES SUBCOMMITTEE OF THE SENATE ENERGY AND NATURAL RESOURCES COMMITTEE

FEBRUARY 10, 1984

I would like to begin, Mr. Chairman, by thanking you for this opportunity to speak on behalf of S. 2186; a bill that I am pleased to support as a cosponsor.

My state has the distinction of being the home of one of the premier mining schools in the country, the Colorado School of Mines. CSM is a charter member of the Mineral Institute program, having been selected as one of the original 22 members by Congress in 1978. As as a participant, CSM has matched dollar for dollar the federally allotted funds.

Under the Mineral Institute program, the School has dedicated one-third of the Institute's monies to student support, and graduate student registrations during the past 5 years has increased by 150, for a total of over 600 graduate students in 1984. The balance of the Institute's activities has been directed to research and educational development, and what it calls "seed" activities. The School of Mines is particularly proud of the fact that research activities have nearly doubled in the past 5 years and will support a $6 million program this year. About 25 percent of this research activity comes from industry contracts, and CSM believes that this is due primarily to the attractiveness of the school as a Mineral Institute.

It is clear that at the Colorado School of Mines, the Mineral Institute has played an integral role in the School's search for excellence in mineral engineering education and research. It is my wish that it continue to do so. By any measure, the Colorado School of Mines stands as an outstanding example of the value and benefit of the Mineral Institute program.

It is my hope that we can move this legislation without delay, and I stand ready to aid you, Mr. Chairman, to that end.

Thank you.

STATEMENT OF HON. JAMES ABDNOR, U.S. SENATOR FROM SOUTH DAKOTA

Mr. Chairman. It is truly a pleasure to appear before you and the other members of the Subcommittee today. I am especially pleased that we are here to address the merits of S. 2186, which would reauthorize the Mining and Minerals Resources Research Institutes. One of the most serious problems facing this nation today is our dangerous dependency on foreign countries for supplies of natural resources which we must obtain if we are to grow and prosper.

In order to make certain that we are addressing the serious problems of our nation's shrinking mineral reserves, we must be willing to provide incentives for students and faculty members to excel in areas associated with mining and minerals. The passage of S. 2186 would ensure continued research in the mining and mineral field. Research is the basis for scientific discovery.

In my home state of South Dakota, the mission of the MMRRI has been to coordinate and administer training and research in the fields of mineral resources, exploration, development and processing in response to the interests and needs of the state, the region and the nation. An institute has been established at the South Dakota School of Mines and Technology in Rapid City, South Dakota. This excellent school has been enhanced even more through MMRRI support resulting in four new faculty positions.

The MMRRI has been involved in studies dealing with fossil fuels (including acquiring title to a coal-gassification plant), and has sponsored several conferences for farmers, ranchers and businessmen addressing oil and gas potential in South Dakota. While members of the Institute have published 12 papers on a wide range of subjects, the scholarship/fellowship grant program has resulted in the awarding of 12 scholarships and 41 graduate fellowships in minerals-related fields.

Other accomplishments of the MMRRI in South Dakota have been in the areas of underground mining of western coals, field testing or rock strength, preparation of a coal mining textbook and upgrading mineral analysis capabilities through the acquisition of new equipment. In short, Mr. Chairman, this program is of enormous benefit to South Dakota and the nation.

With your permission, Mr. Chairman, I should like to submit, for the record, an appendix which lists in greater detail, the accomplishments of the South Dakota MMRRI.

I commend Chairman Warner for his outstanding work in this vital area. Being ever mindful of the fact that we, given the current budget situation, must be able to account for every dollar of taxpayer money that we spend, Senator Warner has fashioned a bill which will reflect the current budgetary restraints which these times demand. But, just as Senator Warner has expressed the need to be prudent, he has shown his strong support for this important program.

We live in a highly competitive and technological world. If we cannot reverse the current trend of graduating fewer and fewer mining and minerals-related engineers, we will fall further and further behind other nations with whom we are competing.

Mr. Chairman, I greatly appreciate having the opportunity to appear before the committee to express my strong support for S. 2186.

APPENDIX A

SOUTH DAKOTA MMRRI
SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY

ACCOMPLISHMENTS
December 1979 - March 1983

1. GENERAL

- Formally established the South Dakota Mining and Mineral Resources and Research Institute at the South Dakota School of Mines and Technology; implemented administrative coordination of all minerals-related graduate training and research with Director of Research and Dean of the Graduate Division serving also as Director of the MMRRI.
- By combining state and MMRRI support, the School was able to add four faculty members with expertise in the areas of coal geology, coal mining, rock mechanics, mining health and safety training, mineral processing, and hydrometallurgy, thereby strengthening and expanding instruction and research in these areas.
- Increased substantially our public service and information activities relating to fossil fuels in South Dakota.
- Initiated negotiations with DOE for the State of South Dakota to acquire title to the Coal Gasification Pilot Plant in Rapid City for the purpose of establishing an industrially-supported chlorine metallurgy research and demonstration facility; disposition of surplus personal property has been completed and transfer of the real property is awaiting GSA action.
- Prepared a proposal for funding through NSF's Science for Citizens Program to educate the citizens of South Dakota on the issues surrounding uranium development in South Dakota, and to seek their involvement; this is a very volatile matter in South Dakota and several other states.
- The scholarship/fellowship grant permitted the award of 9 scholarships and 28 graduate fellowships in minerals-related fields. The FY 1983 allotment grant funded an additional 3 scholars and 5 fellows. Fellows represent 15% of the total number of Master's candidates enrolled in these fields in the Fall of 1980, 1981, and 1982.
- Established the Institute for the Study of Mineral Deposits, in the Fall of 1981, under the leadership of Dr. James J. Papike as Director.
- Submitted a proposal to the South Dakota Board of Regents for a Ph.D. program in Materials Engineering and Science to expand minerals and materials graduate education; most probable implementation date is Fall 1984.

- Acquired an AA/ICP spectrometer.
- Acquired an electron microprobe with wave-length and energy dispersive capability.
- Established coal research and training, with particular emphasis on western coals as a major thrust area for the School.

2. MINERAL RESOURCES

- Preliminary studies were conducted to permit a request for funding from DOE for a mineral resources project entitled "Magnetic and Gravity Studies of the Cheyenne River Area".
- Preliminary field studies were conducted of Tertiary intrusion complexes in the Northern Black Hills in preparation for a request for funding for additional work on Black Hills mineral resources.
- Stratigraphic studies were conducted on the Northern Black Hills with direct application to the petroleum potential of the adjoining Williston Basin areas of North and South Dakota.
- Preliminary work on the evaluation of the mineral resources on Indian reservations resulted in the award by United Sioux Tribes of a grant to catalog, in detail, such resources on five reservations for tribal mineral policy decisions; the project was completed and is expected to lead to more extensive evaluations and actual exploration. Renewed interest has been expressed by representatives of the Pine Ridge Reservation.
- A coal geology curricular component was developed and a coal research laboratory established and equipped to facilitate coal research and permit the training of future coal experts for industry and government agencies.
- More recently, the scanning electron microscope and energy dispersive analyzer were adapted for mineral analyses to augment coal characterization capability.
- Studies of Cretaceous and Tertiary coals of the Powder River Basin and South Dakota have led to the cataloging of the needs of industry in the region, and to indispensable industrial liaison.
- Shared in the development of a short course on coal geology to be sponsored by and for industrial members of the American Association of Petroleum Geologists.
- With the encouragement and endorsement of the Governor and cognizant state agencies, planned and co-hosted with the State Geological Survey, three conferences for farmers and ranchers on oil and gas potential in South Dakota, drawing over 400 attendees, and one for industry drawing over 200.

- Consolidated available offerings in the Department of Geology and Geological Engineering into a well-defined mineral exploration graduate-level instructional and research thrust area.

- Initiated planning for the establishment of a joint graduate program in geophysical exploration among the Departments of Physics, Electrical Engineering, and Geology and Geological Engineering, and a joint program in geotechnical engineering between the Departments of Civil Engineering and Geology and Geological Engineering in order to intensify and broaden training in mineral resources and exploration.

- Planning for the establishment of a geological image processing center at the SDMS&T; several short courses on remote sensing as applied to mineral exploration have been presented with the 4th annual conducted April 25-30, 1982. Funding from NSF for FY 1984 will permit the installation of key image processing instrumentation.

- Received a grant through the Title III Research Grants Program to study a mechanism proposed for converting pyrite to a magnetic material in order to facilitate the extraction of sulfur from coal; the benefits to environmental quality and the cost of pollution control are expected to be substantial.

- Acquired, through this research grant, a superconducting magnetometer facility which is unique in the nation in its application to minerals research.

- Recognition of the Institute's developing coal characterization expertise was reflected in the invitation to Dr. F.J. Rich as the only academician to attend EPRI's meeting in Salt Lake City in March 1983 on western coal quality research needs and priorities.

- Appointment of Dr. Rich as Distinguished Lecturer during 1982-83 on coal geology for the American Association of Petroleum Geologists.

- Initiated dialogue with personnel at the North Dakota MMRRI at the University of North Dakota and Grand Forks Energy Technology Center to provide a coal characterization component of joint research activities.

- Conducted a study of the geometry and stratigraphy of the Late Precambrian Sioux quartzite as regards uranium potential in the basal conglomerates.

- Conducted studies for the U.S. Geological Survey related to ground and surface water uses on the High Plains.

- Completed compilation of a tectonic map of the Black Hills uplift, Wyoming and South Dakota, to be published by the South Dakota and Wyoming Geological Surveys.

- Completed compilation and report preparation on Precambrian geology of the Nemo-Piedmont quadrangles, South Dakota.

- Completed calorimeter designs for use in determination of self-heating potential of commonly mined western coals. This is necessary for the study of spontaneous combustion.
- Conducted studies of subsurface geology of the Powder River Basin, Wyoming.

3. MINERAL PROCESSING

- The Department of Metallurgical Engineering organized the first Western Regional Conference on Gold, Silver, Uranium, and Coal, hosted by the Black Hills Chapter of the AIME in September 1980. The proceedings, edited by Drs. Fuerstenau and Palmer was published in January 1983.
- A technique was developed for measuring the thermodynamic properties of liquid multi-component alloys and slags using a modified time-of-flight Mass Spectrometer/Knudsen Cell Inlet System.
- A technique was developed for quantitatively identifying the amount of each crystalline phase in a complex mineral agglomerate using a computer-based energy dispersive x-ray diffractometer.
- Conducted a study of possible uranium recovery from the lignite coals located in western South Dakota; it was shown that due to the low ore grades involved and the high concentration of soluble impurities in the lignite, standard processing techniques are currently not economically viable.
- A published paper was nominated for a best paper award by AIME. This paper contributes in a major way to our understanding of the mechanism by which sulfide minerals dissolve in chloride-bearing media.
- A paper was published on the natural floatability of sulfide which has helped delineate mechanisms involved in sulfide flotation.
- Four other papers were published, are in press, or have been accepted for publication which report significant advances in the processing of nickel and cobalt ores. Six other papers were published in FY 1983 to date.
- Dr. M. C. Fuerstenau, Manager of the Mineral Processing Program and Head, Department of Metallurgical Engineering served as President of the Society of Mining Engineers in 1982-83, an honor almost unique for an academician.

4. MINING

- Presented a short course on "Introduction to Mining" to state agency employees at the state's request in summer 1980.

- Provided assistance to the Department of Water and Natural Resources in the development of a mineral policy and mining regulations for South Dakota as mandated by the 1981 legislature, and approved in 1982.

- Preliminary studies of mechanisms for improving mine health and safety instruction resulted in an industrially-sponsored program to develop the incorporation of computer-assisted techniques (PLATO) into the curriculum.

- A study of the state-of-the-art of surface mining dust control was completed as the first step in the initiation of research in this critical problem area. This will be coordinated with research on spontaneous combustion.

- Several projects on thermal conductivity in natural materials under pressure are contributing significantly to the solution of complicated mine ventilation problems.

- Participated as technical consultants to the South Dakota State Select Committee on Mining responsible for revising and updating exploration and mining statutes.

- Collaborated in a study with the Biology Department on the effect of cyanide on six different plant species and the effect of selenium toxicity on livestock.

- Initiated projects with a local mining company to improve reserve estimation techniques and production efficiency.

- Developed a temperature probe designed to measure rock temperatures at various depths along drill holes.

- Made significant advances in the characterization of the properties of Kasota dolomite for suitability as underground storage of compressed air and other media.

- Accelerated iInteractions with western mining industry in order to enhance industrial support for research and training.

- Dr. Hladysz' work on rapid methods of determining rock strength resulted in an invitation to visit the USBM Research Center in Denver to discuss and initiate cooperative efforts.

STATEMENT IN SUPPORT OF S. 2186
A STATE MINING AND MINERAL RESOURCES RESEARCH INSTITUTE PROGRAM

MR. CHAIRMAN:

I SPEAK TO SUPPORT S.2186 TODAY BECAUSE I BELIEVE THAT THE PROGRAM AUTHORIZED BY THIS BILL OFFERS ONE OF THE FEW OPPORTUNITIES TO SUPPORT STUDENTS INTERESTED IN STUDYING MINERAL ENGINEERING. THE PUBLIC'S COMMITMENT TO THE PREPARATION OF THIS KIND OF EXPERTISE IS VITAL TO THIS NATION'S CONTINUED ABILITY TO COMPETE IN THE WORLD MINERALS MARKETPLACE.

THE SUPPORT WHICH THIS PROGRAM GIVES TO MINERALS RESEARCH WILL NOT ONLY STRENGTHEN THE MINING INDUSTRY BUT WILL GIVE THAT INDUSTRY A NEW DIRECTION AND EXPERTISE IN DEVELOPING TECHNOLOGIES WHICH ARE CAPABLE OF RESPONDING TO THE PUBLIC'S CONCERNS ABOUT THE POSSIBLE ADVERSE ENVIRONMENTAL EFFECTS OF VARIOUS TYPES OF MINING.

THIS IS NECESSARY LEGISLATION IF THIS COUNTRY IS TO SUPPORT THE NATIONAL NEED FOR DEVELOPMENT, EXTRACTION, AND PROCESSING OF STRATEGIC AND CRITICAL MINERALS.

SEN JOHN MELCHER

U.S. SENATOR
ROBERT C. BYRD
WEST VIRGINIA

Phone: (202) 224-3904

Statement of

Senator Robert C. Byrd

Committee on Energy and Natural Resources

Subcommittee on Energy and Mineral Resources

February 10, 1984

on

S. 2186

A bill to establish a State Mining and Mineral Resources Research Institute program, and for other purposes.

Mr. Chairman, I am pleased to have the opportunity to address S. 2186, a bill to continue the Mineral Institute program. I am an original co-sponsor of that legislation. I commend you for introducing this vital bill.

The federally-funded Mining and Mineral Resources Research Institute program has been very valuable to West Virginia. For the past six years, the program has provided $150,000 in research funds for West Virginia University. The funds have permitted WVU to carry out an advanced study of acid mine drainage, which has led to new methods of environmental control and mitigation that are currently being tested in the field by operating coal companies.

The program also provides funding for the Generic Technology Center on Respirable Dust, in co-operation with Pennsylvania State University.

S. 2186 provides a badly-needed multi-year reauthorization for the MMRRI program. While I understand that the Administration does not support this legislation, it is evident from the many co-sponsors of the bill that the Senate will provide strong support for the program. Thank you, Senator Warner, for your consideration.

STATEMENT OF SENATOR MAX BAUCUS
SENATE SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
FEBRUARY 10, 1984
REAUTHORIZATION MINING AND MINERALS RESEARCH INSTITUTES

MR. CHAIRMAN, I WANT TO THANK YOU FOR ALLOWING ME TO PARTICIPATE IN THIS IMPORTANT HEARING. AS AN ORIGINAL COSPONSOR OF THIS LEGISLATION, I KNOW YOU ARE AWARE OF MY INTEREST IN THIS BILL.

A GREAT DEAL OF ATTENTION HAS BEEN GIVEN TO AN IMPENDING MINERALS CRISIS IN THIS COUNTRY THAT IS JUST AS PREDICTABLE AS THE ENERGY CRISIS OF A FEW YEARS AGO. OF THE 32 MINERALS CONSIDERED CRITICAL FOR NATIONAL SECURITY, WE ARE NOW DEPENDENT ON IMPORTS FOR 24 OF THEM.

THE EMINENCE OF THIS CRISIS WAS UNDERSCORED FOR ME AND THE PEOPLE OF MONTANA RECENTLY. ON SEPTEMBER 29, 1980 THE ANACONDA COMPANY, A SUBSIDIARY OF ATLANTIC RICHFIELD, ANNOUNCED THE IMMEDIATE CLOSURE OF ITS COPPER SMELTER IN ANACONDA, MONTANA, AND ITS REFINERY IN GREAT FALLS, MONTANA. THE RESULTING IMPACT ON MONTANA'S ECONOMY AND THE 1,500 WORKERS WHO LOST THEIR JOBS WAS A TREMENDOUS SHOCK. BEYOND THAT, THE CLOSURES REFLECT A DISTURBING PATTERN IN NOT ONLY OUR DOMESTIC COPPER INDUSTRY, BUT ALSO IN OUR MINERAL INDUSTRY IN GENERAL.

A STRONG COMMITMENT TO MINERALS RESEARCH AND TO THE TRAINING OF MINERALS ENGINEERS AND SCIENTISTS IS CRITICAL IF WE ARE TO STEM THE TIDE OF THIS IMPENDING CRISIS. THE STATE MINING AND MINERALS RESOURCES RESEARCH INSTITUTE BILL WILL GO A LONG WAY IN MEETING THAT OBJECTIVE.

IT IS EXTREMELY IMPORTANT THAT THE FEDERAL GOVERNMENT SHOW A STRONG COMMITMENT TO SUPPORTING SPECIFIC MINERAL RESEARCH AND DEMONSTRATION PROJECTS OF BROAD APPLICATION WHICH WILL MAKE THE MINERALS INDUSTRY IN THIS COUNTRY MORE COMPETITIVE IN INTERNATIONAL MARKETS AND MOVE US, ONCE AGAIN, TOWARDS MINERALS INDEPENDENCE.

IT IS IMPORTANT THAT MINERALS RESEARCH BE TIED MORE DIRECTLY TO MEETING NATIONAL GOALS. I BELIEVE THIS LEGISLATION TAKES THE NECESSARY STEP IN SETTING UP A COMMITTEE ON MINING AND MINERAL RESOURCES RESEARCH. IT IS TIME THAT A NATIONAL PLAN FOR RESEARCH AND DEVELOPMENT IN MINING AND MINERAL RESOURCES BE DEVELOPED. ONLY BY CAREFULLY TARGETTING OUR EFFORTS WILL WE STRENGTHEN THE ROLE OF THE UNITED STATES IN MEETING ITS MINERALS NEEDS.

OF PARTICULAR INTEREST TO WESTERN STATES LIKE MONTANA AND IDAHO IS THE NEED TO DEVELOP PROCESSING AND EXTRACTION METHODOLOGIES FOR CHROMITE AND TANTALUM. BOTH OF THESE MATERIALS ARE NEEDED FOR NATIONAL DEFENSE. BOTH MONTANA AND IDAHO ARE LEADING SOURCES FOR THESE MINERALS. IT IS MY HOPE THAT THIS LEGISLATION CAN PROVIDE A BASIS FOR THE DEVELOPMENT OF INNOVATIVE TECHNOLOGY SUCH AS PLASMA REFINING AND SMELTING TO MEET THIS NEED.

I SUPPORT THIS LEGISLATION AND LOOK FORWARD TO WORKING WITH YOU TO ENSURE ITS PASSAGE BY THE SENATE.

II

98TH CONGRESS
1ST SESSION

S. 2186

To establish a State mining and mineral resources research institute program, and for other purposes.

IN THE SENATE OF THE UNITED STATES

NOVEMBER 18 (legislative day, NOVEMBER 14), 1983

Mr. WARNER (for himself, Mr. BYRD, Mr. MCCLURE, Mr. JOHNSTON, Mr. LAXALT, Mr. FORD, Mr. ANDREWS, Mr. RANDOLPH, Mr. ABDNOR, Mr. BAUCUS, Mr. TRIBLE, Mr. DECONCINI, Mr. GORTON, Mr. BOSCHWITZ, Mr. DURENBERGER, Mr. SYMMS, Mr. MURKOWSKI, and Mr. DIXON) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

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A BILL

To establish a State mining and mineral resources research institute program, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

AUTHORIZATION OF STATE ALLOTMENTS TO INSTITUTES

SECTION 1. (a)(1) Subject to the provisions of paragraph (2), there are authorized to be appropriated to the Secretary of the Interior (hereafter in this Act referred to as the "Secretary") funds adequate to provide for each participating State $300,000 for the fiscal year ending September 30, 1985, and $400,000 for each fiscal year thereafter for a total of five years, to assist the States in carrying on the work of a competent and qualified mining and mineral resources research institute or center (hereafter in this Act referred to as the "institute") at one public college or university in the State which meets the eligibility criteria established in section 10.

(2)(A) Funds appropriated under this section shall be made available for grants to be matched on a basis of no less than one and one-half non-Federal dollars for each Federal dollar during the fiscal years ending September 30, 1985, and September 30, 1986, and no less than two non-Federal dollars for each Federal dollar during the fiscal years ending September 30, 1987, September 30, 1988, and September 30, 1989.

(B) If there is more than one such eligible college or university in a State, funds appropriated under this Act shall, in the absence of a designation to the contrary by act of the legislature of the State, be granted to one such college or university designated by the Governor of the State.

(C) Where a State does not have a public college or university eligible under section 10, the Committee on Mining and Mineral Resources Research established in section 9 (hereafter in this Act referred to as the "Committee") may allocate the State's allotment to one private college or university which it determines to be eligible under such section.

(b) It shall be the duty of each institute to plan and conduct, or arrange for a component or components of the college or university with which it is affiliated to conduct, competent research, investigations, demonstrations, and experiments of either a basic or practical nature, or both, in relation to mining and mineral resources, and to provide for the training of mineral engineers and scientists through such research, investigations, demonstrations, and experiments. The subjects of such research, investigations, demonstrations, experiments, and training may include exploration, extraction, processing, development, production of mineral resources, mining and mineral technology, supply and demand for minerals, conservation and best use of available supplies of minerals, the economic, legal, social, engineering, recreational, biological, geographic, ecological, and other aspects of mining, mineral resources, and mineral reclamation; having due regard to the interrelationship with the natural environment, to the varying conditions and needs of the respective States, and to mining and mineral resources research projects being conducted by agencies of the Federal and State Governments, and by other institutes.

RESEARCH FUNDS TO INSTITUTES

SEC. 2. (a) There is authorized to be appropriated to the Secretary $7,500,000 for the fiscal year ending September 30, 1985, said amount to be increased by $1,000,000 for each fiscal year thereafter for four additional years, which shall remain available until expended. Such funds when appropriated shall be made available to institutes to meet the necessary expenses for purposes of—

(1) specific mineral research and demonstration projects of broad application, which could not otherwise be undertaken, including the expenses of planning and coordinating regional mining and mineral resources research projects by two or more institutes, and

(2) research into any aspects of mining and mineral resources problems related to the mission of the Department of the Interior, which are deemed by the Committee to be desirable and are not otherwise being studied.

(b) Each application for funds under subsection (a) of this section shall, among other things, state the nature of the project to be undertaken, the period during which it will be pursued, the qualifications of the personnel who will direct and conduct it, the estimated costs, the importance of the project to the Nation, region, or State concerned and its relation to other known research projects theretofore pursued or being pursued, the extent to which the proposed project will provide opportunity for the training of mining and mineral engineers and scientists, and the extent of participation by nongovernmental sources in the project.

(c) The committee shall review all such funding applications and recommend to the Secretary the use of the institutes insofar as practicable to perform such special research, and shall recommend institutes for the performance of such special research on the basis of qualifications without regard to race or sex of the personnel who will conduct and direct it, and on the basis of the facilities available in relation to the particular needs of the research project, special geographic, geologic, or climatic conditions within the immediate vicinity of the institute in relation to any special requirements of the research project, and the extent to which such project will provide opportunity for training individuals as mineral engineers and scientists. The Committee shall recommend to the Secretary the designation and utilization of such portions of the funds authorized to be appropriated by this section as it deems appropriate for the purpose of providing scholarships, graduate fellowships, and postdoctoral fellowships.

(d) No funds shall be made available under subsection (a) of this section except for a project approved by the Secretary and all funds shall be made available upon the basis of merit of the project, the need for the knowledge which it is expected to produce when completed, and the opportunity it provides for the training of individuals as mineral engineers and scientists.

(e) No funds made available under this section shall be applied to the acquisition by purchase or lease of any land or interests therein, or the rental, purchase, construction, preservation, or repair of any building.

FUNDING CRITERIA

SEC. 3. (a) Funds available to institutes under sections 1 and 2 of this Act shall be paid at such times and in such amounts during each fiscal year as determined by the Secretary, and upon vouchers approved by him. Each institute shall—

(1) set forth its plan to provide for the training of individuals as mineral engineers and scientists under a curriculum appropriate to the field of mineral resources and mineral engineering and related fields;

(2) set forth policies and procedures which assure that Federal funds made available under this Act for any fiscal year will supplement and, to the extent practicable, increase the level of funds that would, in the absence of such Federal funds, be made available for purposes of this Act, and in no case supplant such funds; and

(3) have an officer appointed by its governing authority who shall receive and account for all funds paid under the provisions of this Act and shall make an annual report to the Secretary on or before the first day of September of each year, on work accomplished and the status of projects underway, together with a detailed statement of the amounts received under any provisions of this Act during the preceding fiscal year, and of its disbursements on schedules prescribed by the Secretary.

If any of the funds received by the authorized receiving officer of any institute under the provisions of this Act shall by any action or contingency be found by the Secretary to have been improperly diminished, lost, or misapplied, such funds shall be replaced by the State concerned and until so replaced no subsequent appropriation shall be allotted or paid to any institute of such State.

(b) The institutes are authorized and encouraged to plan and conduct programs under this Act in cooperation with each other and with such other agencies and individuals as may contribute to the solution of the mining and mineral resources problems involved, and moneys appropriated pursuant to this Act shall be available for paying the necessary expenses of planning, coordinating, and conducting such cooperative research.

DUTIES OF THE SECRETARY

SEC. 4. (a) The Secretary shall administer this Act and, after full consultation with other interested Federal agencies, shall prescribe such rules and regulations as may be necessary to carry out its provisions. The Secretary shall furnish such advice and assistance as will best promote the purposes of this Act, shall participate in coordinating research initiated under this Act by the institutes, shall indicate to them such lines of inquiry as to him seem most important, and shall encourage and assist in the establishment and maintenance of cooperation by and between the institutes and between them and other research organizations, the United States Department of the Interior, and other Federal establishments.

(b) On or before the first day of July in each year beginning after the date of enactment of this Act, the Secretary shall ascertain whether the requirements of section 3(a) have been met as to each institute and State.

(c) The Secretary shall make an annual report to the Congress of the receipts, expenditures, and work of the institutes in all States under the provisions of this Act. The Secretary's report shall indicate whether any portion of an appropriation available for allotment to any State has been withheld and, if so, the reason therefor.

AUTONOMY

Sec. 5. Nothing in this Act shall be construed to impair or modify the legal relationship existing between any of the colleges or universities under whose direction an institute is established and the government of the State in which it is located, and nothing in this Act shall in any way be construed to authorize Federal control or direction of education at any college or university.

MISCELLANEOUS PROVISIONS

Sec. 6. (a) The Secretary shall obtain the continuing advice and cooperation of all agencies of the Federal Government concerned with mining and mineral resources, of State and local governments, and of private institutions and individuals to assure that the programs authorized by this Act will supplement and not be redundant with respect to established mining and minerals research programs, to stimulate research in otherwise neglected areas, and to contribute to a comprehensive nationwide program of mining and minerals research, having due regard for the protection and conservation of the environment. The Secretary shall make generally available information and reports on projects completed, in progress, or planned under the provisions of this Act, in addition to any direct publication of information by the institutes themselves.

(b) Nothing in this Act is intended to give or shall be construed as giving the Secretary any authority over mining and mineral resources research conducted by any agency of the Federal Government, or as repealing or diminishing existing authorities or responsibilities of any agency of the Federal Government to plan and conduct, contract for, or assist in research in its area of responsibility and concern with regard to mining and mineral resources.

(c) No research, demonstration, or experiment shall be carried out under this Act by an institute financed by grants under this Act, unless all uses, products, processes, patents, and other developments resulting therefrom, with such exception or limitation, if any, as the Secretary may find necessary in the public interest, be available promptly to the general public. Patentable inventions shall be governed by the provisions of Public Law 97-516. Nothing contained in this section shall deprive the owner of any background patent relating to any such activities of any rights which that owner may have under that patent.

(d) There are authorized to be appropriated such sums as are necessary for the printing and publishing of the results of activities carried out by institutes under this Act and for administrative planning and direction, but such appropriations shall not exceed $1,000,000 in any single fiscal year.

CENTER FOR CATALOGING

SEC. 7. The Secretary shall establish a center for cataloging current and projected scientific research in all fields of mining and mineral resources. Each Federal agency doing mining and mineral resources research shall cooperate by providing the cataloging center with information on work underway or scheduled by it. The cataloging center shall classify and maintain for public use a catalog of mining and mineral resources research and investigation projects in progress or scheduled by all Federal agencies and by such non-Federal agencies of government, colleges, universities, private institutions, firms, and individuals as may make such information available.

INTERAGENCY COOPERATION

SEC. 8. The President shall, by such means as he deems appropriate, clarify agency responsibility for Federal mining and mineral resources research and provide for interagency coordination of such research, including the research authorized by this Act. Such coordination shall include—

(1) continuing review of the adequacy of the Government-wide program in mining and mineral resources research;

(2) identification and elimination of duplication and overlap between agency programs;

(3) identification of technical needs in various mining and mineral resources research categories;

(4) recommendations with respect to allocation of technical effort among Federal agencies;

(5) review of technical manpower needs, and findings concerning management policies to improve the quality of the Government-wide research effort; and

(6) actions to facilitate interagency communication at management levels.

COMMITTEE

SEC. 9. (a) The Secretary shall appoint a Committee on Mining and Mineral Resources Research composed of—

(1) the Assistant Secretary of the Interior responsible for minerals and mining;

(2) the Director, Bureau of Mines, or his delegate;

(3) the Director, United States Geological Survey, or his delegate;

(4) the Director of the National Science Foundation, or his delegate;

(5) the President, National Academy of Sciences, or his delegate;

(6) the President, National Academy of Engineering, or his delegate; and

(7) not more than six other persons who are knowledgeable in the fields of mining and mineral re-

sources research, including three university administrators involved in the conduct of programs authorized by section 301 of the Surface Mining Control and Reclamation Act of 1977 and recommended by the National Association of State Universities and Land-Grant Colleges, and three representatives from the mining industry recommended by mining industry organizations.

(b) The Committee shall consult with, and make recommendations to, the Secretary on all matters relating to mining and mineral resources research and such determinations as are required to be made under this Act. The Secretary shall consult with, and consider recommendations of, such Committee in such matters.

(c) Committee members, other than officers or employees of Federal, State, or local governments, shall be, for each day (including traveltime) during which they are performing Committee business, paid at a rate fixed by the Secretary but not in excess of the daily equivalent of the maximum rate of pay for grade GS–18 of the General Schedule under section 5332 of title 5 of the United States Code.

(d) The Committee shall be jointly chaired by the Assistant Secretary of the Interior responsible for minerals and mining and a person to be elected by the Committee from among the members referred to in paragraphs (5), (6), and (7) of subsection (a) of this section.

(e) The Committee shall develop a national plan for research and development in mining and mineral resources, considering ongoing efforts in the universities, the Federal Government, and the private sector, and shall formulate and recommend a program to implement the plan utilizing resources provided for under this Act. The Committee shall submit such plan to the Secretary, the President, and the Congress on or before March 1, 1986, and shall update the plan annually thereafter.

(f) The Federal Advisory Committee Act (5 U.S.C. App.) shall not apply to the Committee.

ELIGIBILITY CRITERIA

SEC. 10. The Committee shall determine the eligibility of a college or university to participate as a mining and mineral resources research institute under this Act using criteria which include—

(1) the presence of a substantial program of graduate instruction and research in mining or mineral extraction or closely related fields which has a demonstrated history of achievement;

(2) evidence of institutional commitment for the purposes of this Act;

(3) evidence that such institution has or can obtain significant industrial cooperation in activities within the scope of this Act; and

(4) the presence of an engineering program in mining or minerals extraction that is accredited by the Accreditation Board for Engineering and Technology, or evidence of equivalent institutional capability as determined by the Committee.

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United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

FEB 24 1984

Honorable James A. McClure
Chairman, Committee on Energy
and Natural Resources
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

This responds to your request for our views on S. 2186, a bill "To establish a State mining and mineral resources research institute program, and for other purposes."

We oppose enactment of S. 2186.

The State mining and mineral resources research institute program was established by title III of the Surface Mining Control and Reclamation Act of 1977, Public Law 95-87, with funding authorized for a period of 7 years ending with fiscal year 1984. Title VIII of Public Law 95-87 authorized creation of "University Coal Research Laboratories," with funding authorized through June 30, 1983, and title IX established "Energy Resource Graduate Fellowships" with authorization through September 30, 1984. Without any clear reference to the three statutes cited above, S. 2186 would create a new "State Mining and Mineral Resources Research Institute" program.

In the years since the National Academy of Sciences Committee on Mineral Science and Technology issued its seminal report in 1969, there have been some significant changes in the U.S. mineral industry, in government organization and staffing, and in the demand for technically qualified personnel. The 1969 report called attention to the decline of departments of mining engineering and extractive metallurgy and reductions in the numbers of graduates in these disciplines. In the early 1970's, following the oil embargo, projections were made that coal mining in the United States would double to as much as 1.5 billion tons per year by 1985. Following the passage of the Surface Mining Control and Reclamation Act of 1977, there was a significant increase in demand for mining engineers by industry, the Federal Government, and State governments to implement compliance with the detailed regulations developed to implement that Act. Further, for a period, increased regulations under the mine safety and health acts increased demand for mining engineers in both government and industry. Today, we find that most such positions have been filled and that present demand for large numbers of newly trained mining engineers and extractive metallurgists is low.

The Mineral Institute program has changed since its inception in 1978. In the Conference Report on the Department of the Interior's Fiscal Year 1982 Appropriation Act (House Report 97-315, 97th Congress, First Session, November 5, 1981), the Congress directed that the Department of the Interior try to effect a reduction in the number of Institutes. In response, drawing upon the concept of generic centers set forth in the Stevenson-Wydler Technology Innovation Act of 1980 (Public Law 96-480, October 21, 1980), we proceeded to establish five Generic Mineral Technology Centers.

The Institutes are all components of large, viable educational institutions, which derive a large portion of their financial support from State revenues and other non-Federal sources, including industrial research grants and contracts. Information provided by the Institutes in 1982 indicated that State and State agencies (exclusive of instructional funds) provided $20.1 million and private sources $11.5 million for minerals-related research.

Examples of the type of State and industry support available are the Center for Explosives Technology Research established with a $6.5 million State grant at the New Mexico Institute of Mining and Technology and the gift of a $4.8 million minerals laboratory complex presented by UOP, Inc., to the University of Arizona's College of Mines.

The Administration has proposed in the FY 1985 and earlier budgets to discontinue direct Federal funding for the Mineral Institutes because we believe that these institutions now are able to attract financial support from State government and industry, where rightful responsibility for supporting these Institutes resides. In addition, they will continue to compete for contracts and grants from ongoing Federal research programs. The 1985 budget projects that $31.5 million of the research programs in the relevant bureaus at the Department of the Interior and the fossil research programs at the Department of Energy will be carried out by colleges and universities.

The research provisions of the Economic Recovery Tax Act of 1981 should provide some additional stimulus to industrial research, including that carried on in conjunction with universities, and the recovery of the economy should result in continued availability of State revenues for educational purposes.

Therefore, we see no present need for further specific funding of the Mineral Institutes, and we oppose enactment of S. 2186. Further, S. 2186 would make a number of changes in present title III of Public Law 95-87 which we believe are unnecessary and unworkable. For instance, in Public Law 95-87 the Advisory Committee includes representation of all relevant agencies, and is clearly advisory, as such committees should be. In contrast, S. 2186 would appear to put its new committee in more of an operational mode, generally an inadvisable role for committees. At the same time, S. 2186 would enlarge the committee by including three university administrators, clearly raising the specter of conflict of interest or, at the very least, the appearance of conflict of interest. In conclusion, we believe that the Mineral Institute program has been successfully launched, and is now in a position to go forward with State and industry funding.

The Office of Management and Budget has advised that there is no objection to the presentation of this report from the standpoint of the Administration's program.

Sincerely,

Jed O Christensen

Jed O. Christensen

DEPUTY ASSISTANT SECRETARY

Senator WARNER. Each year the Department of Energy does not include this submission to the budget and each year the Congress promptly turns around and puts it in and I anticipate no change this year.

Our leadoff witness is my distinguished friend and colleague, the senior Senator from Alabama. We welcome you, Senator Heflin.

STATEMENT OF HON. HOWELL HEFLIN, A U.S. SENATOR FROM THE STATE OF ALABAMA

Senator HEFLIN. Mr. Chairman, it is a delight to appear before such a distinguished Member of the U.S. Senate who has evidenced his interest, his very influential interest in the affairs of this Nation from armed service activities to the energy resources of America as well as the capability and the realization that we must depend upon research universities in this age of new and changing technologies.

I am pleased to testify this morning in support of S. 2186. I am one of the 29 current cosponsors of this legislation which reauthorizes for 5 years the State mining and mineral resources research institute program.

As you are well aware, Mr. Chairman, this program was created under title III of the Surface Mining Reclamation Act of 1977 and is scheduled to expire on September 30, 1984. S. 2186 and its House counterpart, H.R. 4214, would reauthorize this program fiscal years 1985 through fiscal year 1989.

The program assists States that have public or private universities and colleges maintaining such an institute to meet expenses of mineral research projects related to the Interior Department issues not currently undertaken by that agency. Thirty-one States, including my home State of Alabama, presently have these institutes.

Just as continuous research and new technological developments play vital roles in improving human health and promoting longevity, they likewise play equally significant roles in the long-term health of the mining and minerals industry. It is no secret, Mr. Chairman, that academic institutions are very critical and important performers of research and development. If America is to maintain its leadership in mining and mineral technological innovations, then it must continue to promote and support vigorous research activities at institutions of higher learning.

I believe that coal is the most likely economic energy source of the future. It can and, in fact, ought to supply a substantially larger portion of the world's energy needs than it has previously. Nearly one-tenth of America's coal reserves are located in Alabama. The life expectancy of Alabama's coal reserves is approximately 1,000 years.

Given these facts, imagine how ludicrous it would be for Alabama, in particular, and the Nation in general, to sit back and idly watch this tremendously vital energy resource lay dormant without capitalizing on new research and development aimed at maximizing its recovery from the earth there. Such research and development can best be accomplished by allowing our institutions of higher learning to provide the best and most highly advanced mineral engineering and science education possible, bolstered by private, Federal, and State funding.

Although S. 2186 reduces authorization for allotment grants and research funding, it nevertheless requires increased matching contributions of nonfederal dollars. In my State, I firmly believe that such nonfederal dollars equal and/or exceed the required matching funds. However, this is not true in all of the 31 affected States.

In such instances, hopefully, this will serve as an incentive to State and private supporters to maintain the level of excellence which these institutions have achieved.

It is my understanding that the other changes in S. 2186 with regard to eligibility criteria and administration of the program are supported by the 31 institutes.

Mr. Chairman, I am delighted to acknowledge the presence of Dr. J. Read Holland, director of the University of Alabama School of Mines and Energy Development. I believe he is going to chair the university panel presentation today.

Dr. Holland is eminently qualified in his field and does a great job. I am delighted to support this bill and I urge its speedy passage through the Congress in order that we might reauthorize this very important legislation as we enter into an era of new and changing technologies.

Senator Warner. I thank the senior Senator and I extend my appreciation to him in recognition of the fact that the Senate is in recess and in all likelihood it was a personal sacrifice on your part to remain over. Recognizing the importance of this to your State, you did that, and I hope your constituents will appreciate it as much as I do.

Thank you, Senator, very much.

We will now hear from Congressman James F. McNulty of Arizona.

Mr. McNulty.

STATEMENT OF HON. JAMES F. McNULTY, JR., A U.S. REPRESENTATIVE FROM THE STATE OF ARIZONA

Mr. McNulty. Good morning, Mr. Chairman, and thank you. I hope I am as persuasive before you this morning as you were on the subject of Lynchburg before the public transportation committee the day before yesterday.

Senator Warner. I can assure you that this measure on which you are speaking will meet with success. I hope you can give me the like assurance.

Mr. McNulty. I could not give you such an assurance. My very brief tenure is such that I can only assure you of my own personal commitment to that measure and I do so.

I am happy to have a chance to speak here this morning to you and to join Dr. McGregor and many of his colleagues from the world of higher education and my friend Mr. Thompson, who has been such a powerful voice on behalf of this measure.

It is my honor to sponsor the companion measure to your bill over in the House of Representatives, H.R. 4214. We have 73 cosponsors over there so far. We had a hearing on February 2 before the Energy and Environment Subcommittee and I am satisfied that we are going to be able to move that bill through the Interior Committee and I would hope shortly.

This subject is not a new one. Under title III of Public Law 95-87 the program that I think is farsighted has begun to authorize the State Mining and Mineral Resources Research Institutes. That title expires in the present fiscal year and new authorization is required.

Our country is competing with all of the industrial powers of this Earth in the competition of technical excellence and national security and we cannot succeed without a basic foundation and knowledge and qualified people who are trained in that knowledge. We cannot settle for second best and these institutes make an important and cost effective contribution to those goals.

My claim simply is we ought to build on the experience of the past 5 years and S. 2186 brings significant and strengthening changes to those efforts. The highlights of the bill are the authorization for each qualified institute for its instructional and high technological education activities of $300,000 for fiscal year 1985 and $400,000 for each of the following 4 years.

Mining research and demonstrations of projects of broad application are authorized with funding levels of $7.5 million for the next fiscal year, increasing 1 million in each succeeding fiscal year through the 5-year authorization.

With respect to our need to conserve national moneys, funding for the educational component or what are called allotments is to be enhanced by State contribution.

The matching formula calls for $1.50 non-Federal dollars for each $1 Federal in the first 2 years and that ratio is increased two for one in the final 3 years.

The existing advisory committee is strengthened by including three representatives of industry and three from the academic community. This will encourage cooperation and in my opinion ought to improve the quality and the relevance of decisions made on the national agenda.

The committee should reflect the diversity of interests in mining research across our Nation and I would like the record to show it is my intent at least that three representatives of industry and three academic officials are chosen from various States and various sectors of industrial activity. Because I think anything less would subtract from our desire to strengthen the national effort.

Objective criteria are specified by statute for use by the committee. And there are four standards.

One, there is a substantial program with a demonstrated history of achievement.

Two, there is evidence of institutional commitment.

Three, significant industrial cooperation.

Four, that a program has been accredited or that there is evidence of a substantial program in the disciplines connected with mining.

A final feature of the bill is to require the preparation of a national plan for research and development in mining and mineral resources and recommend a program to implement the plan so constructed and not just break some new ground, but I think useful, intelligent ground.

You will be hearing later this morning from representatives of government, private industry and higher education, people who have had experience with the program in the past 5 years and who have been involved in one way or another.

I lived 33 years as a country lawyer in a copper mining camp in Bisbee, Ariz., before I began to work here in the House of Representatives and I do not merely concede but claim that that makes me perhaps somewhat more mindful of the problems and the prospects of the American copper industry, which today are very bad indeed.

Since the creation of the program at the University of Arizona, I have known the strength of its program. I know that it has an excellent program. An important practical impact has been its research on sulfuric acid production. A state of the art research program has focused on the use of remote sensing technology to determine the environmental consequences of mining operations.

And so in a fundamental way the dispersion of research to the State level is uniquely suited to the nature of the minerals and mining activities of this country. The vision of those who drafted title III and the original law recognized the varied character of our minerals economy. I say let us build on the successes under title III, under S. 2186 and the House equivalent and that this will provide the framework for a healthier and more productive minerals industry in the future.

Thank you for your consideration and support and I salute you on this timely legislation.

[The prepared statement of Mr. McNulty follows:]

James F. McNulty, Jr.
Statement in Support of S. 2186
February 10, 1984

Mr. Chairman, I appreciate the opportunity to appear and urge your consideration S. 2186, a bill to authorize State Mining and Mineral Resources Research Institute programs. I have the honor of being the sponsor of the companion measure in the House of Representatives, HR 4214. The House measure has 73 cosponsors and was given a hearing on February 2, 1984 before the Energy and Environment Subcommittee of the House Committee on Interior and Insular Affairs.

The subject of State Mining and Mineral Resources Research is not a new one. Under Title III of Public Law 95-87 a far sighted program was initiated to authorize the State Mining and Mineral Resources Research Institutes. Title III expires with the present fiscal year and thus a new authorization is required.

The United States is competing with all industrial powers of the earth in a competition for technical excellence and national security. The United States cannot succeed without a basic foundation in knowledge, and qualified people who are trained in that knowledge, in mineral and mining activities. The United States cannot settle for second best. The Mining and Mineral Resources Research Institutes make an important and cost-effective contribution to those goals.

We should build on the experience of the past five years of achievement. S. 2186 brings significant strengthening changes t our national efforts.

Highlights of the bill include: authorization for each qualified institute for its instructional and high technological education activities of $300,000 for FY 85 and $400,000 for each of the following four years.

Mining research and demonstrations of projects of broad application are authorized with funding levels of $7.5 million for the next fiscal year, increasing one million in each succeeding fiscal year through the length of the authorization of 5 years.

Respecting our need to conserve national monies, funding for the educational component or what are called "allotments" is to be enhanced by state contribution. The matching formula calls for $1.50 non-federal dollar for each $1 federal dollar in the first two fiscal years. That ratio is increased to $2 for $1 in the final three fiscal years.

The existing advisory committee under Title III is strengthened by including three representatives of industry and three representatives of the academic community. This will encourage cooperation and should improve the quality and the relevance of decisions on the national research agenda.

The committee will reflect the diversity of interests in mining research across this broad land. The record should show the intent of Congress that three representatives of industry and the three academic officials are chosen from various states and various sectors of industrial activity. Anything less would subtract from our desire to strengthen the national effort.

Objective criteria are specified by statute for use by the committee. Institutes would apply to the committee and be evaluated on four standards:

---that there is a substantial program with a demonstrated history of achievement.

---there is evidence of institutional commitment.

---there exists significant industrial cooperation.

---a program has been accredited, or there is evidence of a substantial education program in the academic disciplines connected with mining and mineral resources knowledge.

A final feature of the bill is to require the preparation of a national plan for research and development in mining and mineral resources and recommend a program to implement the plan so constructed.

You will be hearing later this morning from representatives of government, private industry and higher educational officials who have had experience with the achievements of the past five years and who have been involved in one way or another in consideration of plans to strengthen the program.

Thirty three years as a country lawyer in the copper mine camp of Bisbee, Arizona prior to entering the House of Representatives makes me especially mindful of the problems and the prospects of the American copper industry. Since the creation of the Mining and Mineral Resources Research Institute at the University of Arizona I have known of the strength of its program. Its Director, Dr. Orlo E. Childs has established an excellent program of great value to all in the minerals industry. An important practical impact has been its research on sulphuric acid production. A state-of-the-art research program has focused on the use of remote sensing technology to determine the environmental consequences of mining operations which has alerted industry and government of hazards that should be anticipated in future operations.

In a fundamental way the dispersion of research to the state level is uniquely suited to the nature of the minerals and mining activities of our nation. It was the farsighted vision of those that drafted Title III of Public Law 95-87 which recognized the varied character of our minerals economy. By building on our successes under Title III, S. 2186 and its House equivalent will provide the framework for a healthier and even more productive minerals industry in the future.

I thank you for your consideration of this important and timely legislation.

# # # # #

Senator WARNER. Mr. McNulty, you made reference to Dr. McGregor. Doctor, would you kindly come to the table. We want to express our appreciation to you.

As I understand it, you helped coordinate this witness list for today's hearing. Would you like to say a few words?

Dr. MCGREGOR. Thank you, Senator. I am not normally welcomed in this way. I appreciate it very much. I do not think I have anything to add to the testimony before you. I guess I do have one thing very much on my mind and let me try to articulate it to you, Senator.

The notion about the committee, which Mr. McNulty has designed in this bill, I think is critical. Because it suggests that the publicly funded universities, the Federal Government and the industry sit down together and work out the most effective program. There has been a philosophy in the past, sir, that university administrators and performers of research were advisers to the Government.

I submit that through the State legislatures they bring more resources and activity to this enterprise than does the Federal Government. So that this cooperative relationship, I think, sir, is the essence and the heart of this proposal.

Thank you very much for the opportunity to make these remarks.

Senator WARNER. If I might address this question, since both of you have worked on the bill, to both of you, do you see a potential for conflict of interest by adding three university administrators and three representatives from the mining industry? Further, what if the university administrator and the mining representative are from the same State?

Mr. MCNULTY. Certainly in pure theory there is the possibility of that conflict, but we have to assume that the balance of the members of this committee could be hoodwinked by some one person and I think if you created a committee with folks like that, we have pretty well wasted our time to begin with.

I would suspect that a representative of the University of Arizona, my alma mater, might be able to persuade all the rest of the folks on the committee on the basis that his presentation included matters of such overwhelming merit that the rest would concede to that. If it proves not to work that way, in terms that it would stroke each other's hands, then clearly changes would be needed.

But so far I am willing to rely on what I think is the intellectual rigors that we would have a right to associate with this enterprise.

Senator WARNER. Dr. McGregor.

Dr. MCGREGOR. Yes, I quite concur. Surely, this is a time and place when one thing we need in this country is confidence in one another and the whole spirit of these institutions working together. We have a global enterprise on our hands and it is time we stopped nitpicking at each other and began to work together in constructive ways. I hope we might have confidence in one another.

Senator WARNER. Congressman McNulty, the committee thanks you for remaining in Washington so that you could provide your valuable testimony.

Mr. **McNulty**. The exchange in climates between Arizona and Washington clearly, Senator, favors my home community and I thank you very much for bringing that to the group's attention.

Senator **Warner**. I enjoy a very close professional and working relationship with your Senators. Thank you again. Perhaps you will remain with us, Doctor, throughout the hearing.

Dr. **McGregor**. Yes, I will.

Mr. **McNulty**. Thank you.

Senator **Warner**. We will now hear from our first panel, the Honorable Harold W. Furman, Deputy Assistant Secretary for Water and Science, Department of the Interior; Robert Horton, Director of the U.S. Bureau of Mines. Gentlemen, we welcome you.

STATEMENT OF HON. HAROLD W. FURMAN II, DEPUTY ASSISTANT SECRETARY FOR WATER AND SCIENCE, DEPARTMENT OF THE INTERIOR, ACCOMPANIED BY ROBERT C. HORTON, DIRECTOR, U.S. BUREAU OF MINES, DEPARTMENT OF THE INTERIOR

Mr. **Furman**. Thank you, Mr. Chairman.

Senator **Warner**. Mr. Secretary, we will put your entire statement in the record. Since this is a subject that is known to all and well understood, I would appreciate it if you would highlight those points you wish to stress.

Mr. **Furman**. Yes, Mr. Chairman, I would be happy to. Let me say at the outset, Mr. Chairman, it is a pleasure to be with you this morning to discuss this matter.

I am pleased to be here and to discuss our Mining and Mineral Resources and Research Institute program and to provide our comments on S. 2186. The Bureau of Mines has long been cognizant of the need for cooperative research involving government, industry, and universities.

Indeed, our first research station at Pittsburgh, Pa., was deliberately located next door to the campus of Carnegie Tech, presently Carnegie-Mellon University, which is noted for its mining and metallurgical research. In recent years in almost every instance the Bureau of Mines research laboratories were established on, or in close proximity to, the campuses of major mineral-oriented universities to facilitate the beneficial exchange of professors and graduate students and the efficient utilization of facilities containing specialized equipment.

Our generic mineral technology centers already cover the major processes of the mineral cycle and thus facilitate government-industry-university cooperative research. Mr. Chairman, the Bureau of Mines works closely with all 31 of the existing mineral institutes, including those which are not in the immediate proximity to Bureau research facilities.

In the years since the National Academy of Sciences Committee on Mineral Science and Technology issued its semi-annual report in 1969, there have been some significant changes in the U.S. mineral industry, in Government organization and staffing, and in the demand for technically qualified personnel.

Following the passage of the Surface Mining Control and Reclamation Act of 1977 there was a significant increase in demand for mining engineers by industry, by the Federal Government and

State governments to implement compliance with the detailed regulations developed to implement that important piece of legislation.

Further, for a period, increased regulations under the Mine Safety and Health Acts increased demand for mining engineers in both Government and industry. Today, we find that most such positions have been filled and were filled by younger persons, hopefully, who can look forward to long continuing and rewarding careers. The present demand for large numbers of newly trained mining engineers and extractive metallurgists is now at a low.

The Mineral Institute program has changed as well since its inception in 1978. In the conference report on the Department of the Interior's fiscal year 1982 appropriation, the Congress directed that the Department of the Interior try to effect a reduction in the number of institutes and a consolidation thereof.

Whereupon, drawing upon the concept of generic centers set forth in the Stevenson-Wydler Technology Innovation Act of 1980, we proceeded to establish the five Generic Mineral Technology Centers, which I have already alluded to. These institutes are all components of large, viable educational institutions which derive a large portion of their financial support from State revenues and other non-Federal sources, including industrial research grants and contracts.

Information provided by those institutes in 1982 indicated that State and State agencies provided $20.1 million and private sources $11.5 million for minerals-related research.

The administration has proposed in fiscal year 1985 and earlier budgets to discontinue Federal funding for the mineral institutes, because we believe that these institutions are now able to attract financial support from State government and industry, where rightful responsibility for supporting these institutes resides. The fiscal year 1985 budget projects that $31.5 million of the research programs in the relevant bureaus at the Department of the Interior and the fossil research programs at the Department of Energy will be carried out by universities and colleges.

The research provisions of the Economic Recovery Tax Act of 1981 should also provide some additional stimulus to industrial research, including that carried on in conjunction with the universities.

Consequently, we see at this time no present need for further specific funding of the mineral institutes. S. 2186 would make a number of changes in the present title III of Public Law 95-87, which we believe may be unworkable. For instance, in Public Law 95-87, the advisory committee includes representation of all relevant agencies and is clearly advisory as such committees should be in our mind.

In contrast, S. 2186 would appear to put some of its committee in more of an operation mode which is generally an inadvisable role for committees per se in our mind. At the same time, S. 2186 would enlarge the committee by including three university administrators, which we are afraid may raise at least the appearance of conflict of interest.

In conclusion, then, we believe that the minerals research program has been successfully launched and is now in a position to go forward with State and industry funding.

I would ask that the entire statement be placed in the record.

[The prepared statement of Mr. Furman follows:]

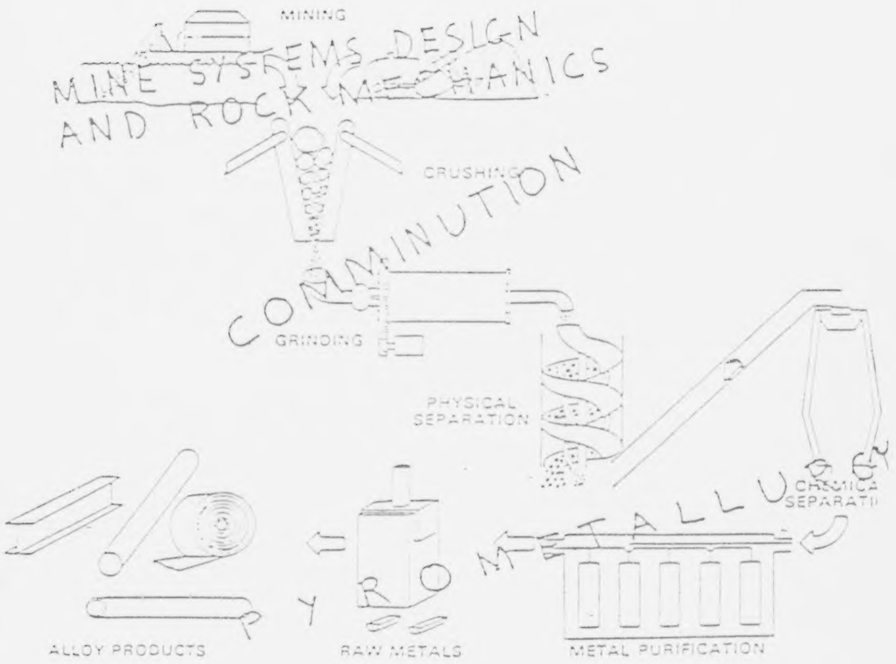
Statement of Harold W. Furman, II
Deputy Assistant Secretary for Water and Science
Department of the Interior
before the
Subcommittee on Energy and Mineral Resources
Committee on Energy and Natural Resources
United States Senate
February 10, 1984

Mr. Chairman, Members of the Committee, Ladies and Gentlemen:

I am most pleased to appear before you this morning to describe the current status of the Department of the Interior's Mining and Mineral Resources and Research Institute program and to provide our comments on S.2186. I am accompanied by Mr. Robert C. Horton, Director, Bureau of Mines.

The Bureau of Mines, which was created in 1910 following President Theodore Roosevelt's Special Message of January 22, 1909, to the Congress, has long been cognizant of the critical need for cooperative research involving the government, industry, and universities. Indeed, our first research station at Pittsburgh, Pennsylvania, was deliberately located next door to the campus of Carnegie Tech - presently Carnegie-Mellon University - noted for its mining and metallurgical research. In future years, in almost every instance, Bureau of Mines Research laboratories were established on, or in close proximity to, the campuses of major mineral-oriented universities, to facilitate the beneficial exchange of professors and graduate students, and efficient utilization of facilities containing specialized equipment. Our Generic Mineral Technology Centers (GMTC) already cover the major processes of the mineral cycle (Figure 1) and thus facilitate government-industry-university cooperative research. In these days of improved communication our Pittsburgh laboratory is close to the Pennsylvania State University, West Virginia University, and Virginia Polytechnic Institute and State University (VPI), all three of which are

Figure 1. HOW THE BUREAU OF MINES GENERIC MINERAL TECHNOLOGY CENTERS (GMTC'S) COVER THE FUNDAMENTAL STEPS IN MINERAL PRODUCTION


MINING
MINE SYSTEMS DESIGN
AND ROCK MECHANICS
CRUSHING
COMMINUTION
GRINDING
PHYSICAL SEPARATION
CHEMICA SEPARATI
PYROMETALLURGY
ALLOY PRODUCTS
RAW METALS
METAL PURIFICATION

MINERAL INDUSTRY WASTE TREATMENT AND RECOVERY and RESPIRABLE DUST cover all steps participants in the Mineral Institute program and which are also Centers of Generic Mineral Technology - Pennsylvania State and West Virginia being joined in the Respirable Dust GMTC and VPI leading the Mine Systems Design and Rock Mechanics GMTC. Our Rolla, Missouri, laboratory is on the campus of the University of Missouri (formerly the Missouri School of Mines), which is a Mineral Institute and GMTC for Pyrometallurgy. Our Reno, Nevada, laboratory is on the campus of the University of Nevada which has a Mineral Institute and is also the GMTC for Mineral Industry Waste Treatment and Recovery, and our laboratory in Salt Lake City, Utah, is on the research park in conjunction with the University of Utah which, too, has a Mineral Institute and the GMTC dealing with Comminution. Other Bureau of Mines laboratories are located at Twin Cities, Minnesota, in close proximity to Michigan Technological University and the University of Minnesota, both of which have Mineral Institutes and our Denver mining research laboratory and regional field center are close to the Colorado School of Mines which has a Mineral Institute at Golden, Colorado. Further, our mining research laboratory and regional field center at Spokane, Washington, is close both to the University of Idaho and the University of Washington, both of which have Mineral Institutes, and so is our research laboratory at Albany, Oregon. In the southern part of the country our research laboratory at Tuscaloosa, Alabama, is on the campus of the University of Alabama which has a Mineral Institute. And, while our field center at Juneau, Alaska, is some distance from the University of Alaska, at Fairbanks, where the Mineral Institute is located, we also have Bureau suboffices at Anchorage and at Fairbanks itself. In addition to the institutions named, the Bureau of Mines works closely with all of the 31 Mineral Institutes, including those which are not in immediate proximity to Bureau research facilities.

In the years since the National Academy of Sciences Committee on Mineral Science and Technology issued its seminal report in 1969, there have been some significant changes in the U.S. mineral industry, in government organization and staffing, and in the demand for technically qualified personnel. The 1969 report called attention to the decline of departments of mining engineering and extractive metallurgy and reductions in the numbers of graduates in these disciplines. Again in the early 1970's, following the oil shock, projections were made that coal mining in the United States would double to as much as 1.5 billion tons per year by 1985. Further, following the passage of the Surface Mining Control and Reclamation Act of 1977 there was a significant increase in demand for mining engineers by industry, by the Federal government, and State governments to implement compliance with the detailed regulations developed to implement that Act. Further, for a period, increased regulations under the mine safety and health acts increased demand for mining engineers in both government and industry. Today, we find that most such positions have been filled and were filled by younger persons hopefully who can look forward to long continuing and rewarding careers, but present demand for large numbers of newly trained mining engineers and extractive metallurgists is low. The Mineral Institute program has changed as well since its inception in 1978. In the Conference Report on the Department of the Interior's Fiscal Year 1982 appropriation (House Report 97-315, 97th Congress, First Session, November 5, 1981) the Congress directed that the Department of the Interior try to effect a reduction in the number of Institutes and consolidation thereof. Whereupon, drawing upon the concept of generic centers set forth in the Stevenson-Wydler Technology Innovation Act of 1980 (Public Law 96-480, October 21, 1980) we proceeded to establish the five Generic Mineral Technology Centers already alluded to.

The Institutes are all components of large, viable educational institutions, which derive a large portion of their financial support from State revenues and other non-Federal sources, including industrial research grants and contracts. Information provided by the Institutes in 1982 indicated that State and State agencies (exclusive of instructional funds) provided $20.1 million and private sources $11.5 million for minerals-related research.

Examples of the type of State and industry support available are the Center for Explosives Technology Research established with a $6.5 million State grant at the New Mexico Institute of Mining and Technology and the gift of a $4.8 million minerals laboratory complex presented by UOP Inc. to the University of Arizona's College of Mines.

The Administration has proposed in the FY 1985 and earlier budgets to discontinue direct Federal funding for the Mineral Institutes because we believe that these institutions now are able to attract financial support from State government and industry, where rightful responsibility for supporting these Institutes resides, and they will continue to compete for contracts and grants from ongoing Federal research programs. The 1985 budget projects that $31.5 million of the research programs in the relevant bureaus at the Interior Department and the fossil research programs at the Department of Energy will be carried out by colleges and universities.

The research provisions of the Economic Recovery Tax Act of 1981 should provide some additional stimulus to industrial research, including that carried on in conjunction with universities, and the recovery of the economy should result in continued availability of State revenues for educational purposes.

Consequently, we see at this time no present need for further specific funding of the Mineral Institutes, and we oppose enactment of S. 2186. Further, S. 2186 would make a number of changes in present Title III of Public Law 95-87 which we believe are unnecessary and unworkable. For instance, in Public Law 95-87 the Advisory Committee includes representation of all relevant agencies, and is clearly advisory, as such committees should be. In contrast S. 2186 would appear to put its new committee in more of an operational mode which is generally an inadvisable role for committees per se. At the same time, S. 2186 would enlarge the committee by including three university administrators, clearly raising the specter of conflict of interest or, at the very least, the appearance of conflict of interest. In conclusion, then, we believe that the Mineral Institute program has been successfully launched, and is now in a position to go forward with State and industry funding.

I have appended to my statement an "Activity Overview" listing the 31 present Mineral Institutes, the five Generic Mineral Technology Centers, and their satellite Mineral Institutes, and a listing of major projects under way in the GMTC's. This concludes my statement and we shall be delighted to respond to such questions as you may wish to pose.

ACTIVITY OVERVIEW

In furtherance of the goal of encouraging support for basic research in the mineral sciences and engineering, allotment grants, which must be matched, are made to 31 designated State mineral institutes (no more than one per State) at prestigious universities. In addition, research grants are made to five generic mineral technology centers in support of research of broad applicability to the minerals industry at selected mineral institutes. Concentration of research funds to develop focal points for research, in particular mineral-related areas, was done in response to a Congressional directive to consolidate the mineral institute program.

Authorization: 30 U.S.C. 1221 (Surface Mining Control and Reclamation Act of 1977, Sections 301 and 302)

Objectives:

- To encourage graduate-level research on national and regional problems in mineral engineering at universities in the several States.
- To train qualified mineral scientists and engineers.
- To facilitate industry-State-Federal cooperation in solving mineral engineering problems.

FY 1983 and FY 1984 Program: The mineral institutes program operates under "Title III - State Mining and Mineral Resources and Research Institutes" of the Surface Mining Control and Reclamation Act of 1977, Public Law 95-87. Under title III, allotment, scholarship/fellowship, and research grants may be made to eligible schools of higher learning to provide training for mineral engineers and scientists through research, investigations, and demonstrations. This Act also provides for an advisory committee, the recommendations of which are considered in the conduct of research and in the making of grants under title III. The Act permits one mineral institute per State and there are currently 31 institutions eligible to receive funds as mineral institutes. The designation of a State school of higher learning as a mineral institute creates a focal point for administering funds for the various academic departments which contribute to mineral engineering research. The 31 eligible institutions are listed below:

MINERAL INSTITUTES

1. University of Alabama
2. University of Alaska - Fairbanks
3. University of Arizona
4. University of California - Berkeley
5. Colorado School of Mines
6. Georgia Institute of Technology
7. University of Idaho
8. Southern Illinois University
9. Purdue University (cont'd.)

10. Iowa State University
11. University of Kentucky
12. Louisiana State University
13. Massachusetts Institute of Technology
14. Michigan Technological University
15. University of Minnesota
16. University of Mississippi
17. University of Missouri - Rolla
18. Montana College of Mineral Science and Technology
19. University of Nevada - Reno
20. New Mexico Institute of Mining and Technology
21. University of North Dakota
22. Ohio State University
23. University of Oklahoma
24. Pennsylvania State University
25. South Dakota School of Mines
26. University of Texas
27. University of Utah
28. Virginia Polytechnic Institute and State University
29. University of Washington
30. West Virginia University
31. University of Wyoming.

On the basis of Advisory Committee recommendations, allotment grants of $150,000 were made to each of the 31 mineral institutes in both FY 1983 and FY 1984. Allotment grants were made July 1 of each year for the ensuing school year on the basis of proposals received from each institute and approved by the Bureau of Mines. In FY 1983, further research grants were made to each of the generic mineral technology centers (GMTC) which were established in FY 1982 and, in addition, a new generic research center in respirable dust was established in FY 1983. The generic centers and their affiliates are as follows:

Generic Area	Center	Affiliates
Mine Systems Design and Ground Control	Virginia Polytechnic Institute and State University	University of Alabama University of Alaska - Fairbanks University of Idaho University of Kentucky University of Nevada - Reno
Comminution	University of Utah	University of Minnesota University of California Colorado School of Mines Michigan Tech New Mexico Tech

Generic Area	Center	Affiliates
Mineral Industry Waste Treatment and Recovery	University of Nevada - Reno	University of Idaho Iowa State University Montana College of Mineral Science and Technology New Mexico Tech
Pyrometallurgy	University of Missouri - Rolla	Purdue
Respirable Dust	Pennsylvania State University and West Virginia University	University of Minnesota Massachusetts Institute of Technology.

Research Underway in FY 1983

Mine Systems Design and Ground Control

- Rock Characterization in Deep Coal-Mines Ground Control
- Optimization of Pillar Dimensions in Permafrost Mines
- Improved Airflow and Climate of Underground Mines
- Ground Control Design Factors in Multiseam Mining
- Ground Control in Longwall Mining

Comminution

- Computer Simulation of Complex Circuits
- Large Grinding Mill Dynamics
- Phenomenological Hydrocyclone Model for Scale-Up
- Comminution of Mineral Mixtures
- Tracer Study of Rod Mill Transport

Mineral Industry Waste Treatment and Recovery

- Precipitation Mechanisms of Heavy Metals
- Fluidized Bed Electrodeposition of Metal from Effluents
- Recovery of Copper and Arsenic From Electrorefining Wastes
- Tailing Fluids Waste Treatment
- Controlling Acid Mine Drainage

Pyrometallurgy

- Injection of Reactants into Molten Fluids with Strongly Coupled Heat Transfer
- Plasma Furnace Facility
- Vacuum Refining
- Mineralogy of Pyrometallurgical Feeds and Products

Research Underway in FY 1983

Respirable Dust

Dispersion and Transport of Respirable Dusts
Construction of Dust Distribution Maps for Longwalls
Fracture Mechanics of Crack Propagation in Coal
Instrumentation of Coal Mine Dust Characterization
Mechanism of Lung Injury of Coal Mine Dusts.

Funds made available to the mineral institutes and to the GMTC's will be available for use over a period of years to permit orderly initiation of research that will attract more and continuing industrial participation.

In fiscal year 1984, the Congress appropriated $9.35 million for the mineral institutes program. Present plans call for using this money to provide another year of base support to eligible Mineral Institutes and to further support the five existing generic centers described above.

Senator WARNER. Mr. Horton, would you wish to add to that?

Mr. HORTON. No, sir, I have no formal statement. I would be pleased to answer any questions you might have.

Senator WARNER. A general procedural item, the committee requested a legislative report on S. 2186 as far back as December 14, 1983. Today, we have still not received that report. Can you advise the committee as to when we might expect it?

Mr. FURMAN. Mr. Chairman, I am not specifically aware of where that report is, but you can be assured that as soon as I get back this morning I will find out and try to get it up to you as expeditiously as possible. We apologize for any delay or inconvenience that this has caused.[1]

Senator WARNER. Mr. Furman, in your statement on page 3 you indicate that the present demand for large numbers of newly trained mining engineers and extractive metallurgists is low. You also indicate in your testimony because of the "oil shock" in the seventies projections were made that coal mining would double and that following the passage of the Surface Mining Control and Reclamation Act of 1977 there was a significant increase in demand for mining engineers by industry, by the Federal Government and by State governments. Do you consider the possibility of another oil shock unlikely or not?

Mr. FURMAN. Mr. Chairman, I think it is entirely possible. I think one only needs to read the newspaper or look at the TV every day to see the disastrous circumstances that we could be faced with. The only thing that I think we wanted to touch on in our testimony was to indicate that at the current time there is a low.

We think there was a need at one time, which we think has been taken care of by highly skilled and trained individuals. At the current time, there is less than a great demand for mining and metallurgical engineers, not to say that there may not be at some time in the future.

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[1] Subsequently, on Feb. 24, 1984 the committee received the Department of the Interior's report. It is reprinted following the text of S. 2186.

Senator **Warner**. What sort of lead time do you think is necessary to gear up for an increase in demand for engineers and metallurgists?

Mr. **Furman**. I think it mostly depends on the age of most of those people who are in the jobs now and, of course, the normal training period that exists in educational institutions.

Senator **Warner**. If such a surge in demand, at least in the scientific profession should occur, do you think the Federal Government should once again get involved?

Mr. **Furman**. I think there may well be a role if that were to happen.

Senator **Warner**. I certainly agree with you. Thank you very much, gentlemen.

Our second panel will consist of Dr. J. Read Holland, director of the School of Mines and Energy Development; Dr. James H. Swisher, director of the Illinois Mining and Mineral Resources Research Institute, Southern Illinois University; Dr. Kenneth J. Reid, director, Mineral Resources Research Center, University of Minnesota; Dr. Lyle Sendlein, director, Institute for Mining and Minerals Research, University of Kentucky; Dr. Richard Lucas, head of the Department of Mining and Minerals Engineering, Virginia Polytechnic Institute and State University.

Gentlemen.

I am delighted that the distinguished members of these faculties decided among themselves who the lead witness would be, notwithstanding protocol, and clearly should not be left to the Chair to decide, so I shall bow to you and lead off with Dr. Holland.

STATEMENT OF DR. J. READ HOLLAND, DIRECTOR, SCHOOL OF MINES AND ENERGY DEVELOPMENT, UNIVERSITY OF ALABAMA

Dr. **Holland**. Mr. Chairman and members of the subcommittee, I am the director of the School of Mines and Energy Development of the University of Alabama and a member of the Committee on Mineral Resources of the National Association of State Universities and Land-Grant Colleges.

I and my colleagues at the table are privileged to be with you this morning and represent the higher education mineral resources community who will offer testimony in support of S. 2186.

We are here to endorse S. 2186 on behalf of the National Association of State Universities and Land-Grant Colleges and also on behalf of the National Association of Directors of Minerals Institutes.

There has been a great deal of time and consultation that has gone into the preparation with staff and others in this bill and we feel this careful and cooperative preparation is reflected in the breadth and depth of support for the bill on the part of higher education and its mineral resources components as well as the mineral community at large.

This program offers an opportunity to continue to strengthen the programs that are of great importance to the universities and the universities in their role as, their educational role, their teaching role, their research role and their service role. These mineral resources research institutes have compiled a notable record of accomplishments under the previous authorizing legislation and that record will be summarized by Dr. Reid.

We feel that if the bill is passed it will provide for a continuation of that record and a continued emphasis on program quality and will assure that future accomplishments will be even more impressive in the future than they have been in the past.

These institutes build recognition for the schools and universities of which they are a part. They help us attract qualified faculties and qualified students and are a very important component and a very difficult component of our program. Let me just cite for you that they contribute very substantially for the pursuit and achievement of excellence at the universities where they are.

In Alabama, for example, we have recently announced the building of an energy and mineral science research complex, a $10 million investment for the State and the university. I submit that would not have happened had there not been a noble record of achievement on the part of our Mining and Mineral Resources Research Institute. So this activity stimulates far greater activity at the State level.

It is very important for the university. It serves a very large purpose at the university and it strengthens our relationship with industry in the higher education component. This creates a mutually beneficial approach to problem solving and we feel that, I feel personally that we have a continuing need for this sort of program. It is not a program that we should put in in the case of an emergency or a crisis situation.

Let me discuss for a moment——

Senator WARNER. Let me direct you to one point, that relates to time, the lead time for training.

Dr. HOLLAND. Yes. This bill, S. 2186, reauthorizes and extends the program for 5 years from fiscal year 1985 through 1989. This provides a sufficiently long period for program continuity and it also provides a period of time in which its accomplishments can be reviewed.

The bill produces the authorization that has just been discussed from $400,000 in 1984, fiscal year 1984, to $300,000 in fiscal year 1985 and $400,000 in subsequent years.

It also reduces the authorization for research funding from $25 million in the current fiscal year to $7.5 million in fiscal year 1985 to be increased by a million dollars per year.

These changes, we feel, were not because of reduced program needs but they reflect the realities that we must face and this being a tight budget year, and we are cognizant of that and recognize that. We believe that we could responsibly use the funds authorized under the original act, but recognize that that is not likely to happen.

However, the $300,000 that we are talking about in this authorization plus the allotment for the institutes plus the research allotment, we feel is a realistic goal to shoot for and the $17 million that would be required as the appropriation is a realistic situation in our viewpoint.

Senator WARNER. Did you give a figure there, a realistic figure?

Dr. HOLLAND. The accompanying appropriation which would implement the authorization bill for the first year, if it is passed, is roughly $17 million, $16.8 million.

Senator WARNER. That is what caught my ear. It was somewhat different from what we had. Is that the generic centers and the institutes?

Dr. HOLLAND. That is the $300,000 per institute, plus the $7.5 million research grant, research fund authorization.

Senator WARNER. All right. We have been in consultation with the distinguished chairman of the committee, Senator McClure, and, of course, you know he is on the Appropriations Committee, and we have not quite figured the exact mark to shoot for yet.

Dr. HOLLAND. We feel that is not an unrealistic mark. It is a mark that certainly can be effectively used. At that level, the State contribution, the total State contribution would be roughly $14 million.

Senator WARNER. Thank you.

Dr. HOLLAND. The State contributions would increase and it has been pointed out, we feel, that enhances the State commitment to the program. The States have a commitment to the program already, but now the States would have an incentive to make a larger contribution. As Senator Heflin pointed out, this may lead some States into very much larger financial commitments to maintain their programs.

We feel that it is an appropriate challenge to the States and the universities to maintain their share of the burden in terms of metal engineering and science education and research. In our State, for example, our funding equals or exceeds that, but the presence of that funding, the presence of the Federal funding assures the continuance of the State funding. And I do not believe that you would see that sort of commitment in the absence of the Federal funding on the State's part.

There is really a spirit of partnership in the situation and we feel that is the best way to approach this. The administrative changes that are recommended in the bill, we feel strengthen the bill and strengthen the program and put a better prospective on the role of these institutes and the total mineral resources research plan undertaken nationally.

Certainly, there is a large State component in it and a State interest in it and a State need to be met and these can be reflected in that plan. But by having the partnership between industry and the universities and government, we do not feel that there is a conflict of interest, because that should be an active partnership.

The eligibility criteria, we feel strengthens the program and makes a closer link between the educational component and the institute program. We think that will enhance the image of the institutes and increase the strength and quality of the program.

I thank you.

[The prepared statement of Dr. Holland and the report "Increasing Supply and Productivity in the Mineral Sector thru Research and Education" follows:]

Statement to the Subcommittee on Energy and Mineral Resources, Senate Committee on Energy and Natural Resources

Concerning S.2186, "a Bill to establish
a State Mining and Mineral Resources Research
Institute program, and for other purposes"

February 10, 1984

Presented on behalf of

The National Association of State Universities and
Land-Grant Colleges (NASULGC)
Mineral Resources Committee

and

The National Association of Mineral Institute Directors

By a panel of university administrators:

Dr. J. Read Holland
Director, School of Mines and Energy Development
University of Alabama, and
Member, NASULGC Mineral Resources Committee

Dr. James Swisher
Director, Coal Research Center, Southern Illinois University
at Carbondale

Dr. Kenneth J. Reid
Director, Mineral Resources Research Center,
University of Minnesota and Chairman,
National Association of Mineral Institute Directors

Dr. Lyle V. A. Sendlein
Director, Institute for Mining and Minerals
University of Kentucky

Dr. J. Richard Lucas
Head, Department of Mining and Minerals Engineering
Virginia Polytechnic Institute & State University

INTRODUCTION

Mr. Chairman, Members of the Subcommittee, my name is Read Holland. I am the Director of the School of Mines and Energy Development of the University of Alabama and a member of the Committee on Mineral Resources of the National Association of State Universities and Land-Grant Colleges (NASULGC).

It is my privilege to introduce to you this morning representatives of the higher education mineral resources community who will offer testimony in support of S.2186. In order of their presentations, these representatives are:

Dr. James Swisher, Director of the Coal Research Center, Southern Illinois University at Carbondale. Dr. Swisher will propose a technical amendment to S. 2186. That amendment has the support of our panel, as well as of NASULGC and the association of institute directors.

Dr. Kenneth J. Reid, Chairman of the National Association of Mining and Mineral Resources Research Institute Directors and Director of the Mineral Resources Research Center at the University of Minnesota.

Dr. Lyle V. A. Sendlein, Director, Institute for Mining and Minerals, University of Kentucky.

Dr. J. Richard Lucas, Head, Department of Mining and Minerals Engineering, Virginia Polytechnic Institute and State University.

We are all here to endorse S. 2186 on behalf of these two associations and their institutional members. A great deal of time, effort, concern and consultation has been invested in the preparation of the bill. This careful and cooperative preparation is reflected in the breadth and depth of support for the bill on the part of higher education and its mineral resources components.

S. 2186 offers an opportunity to continue and strengthen programs of great importance to many universities. The minerals resources research institutes have compiled a notable record of accomplishment under previous authorizing legislation, a record that will be summarized by Dr. Reid. The bill, if passed, will provide for the continuation of that record and, because of its emphasis on program quality, will assure that future accomplishments will be even more impressive.

The institutes build recognition for the schools and universities of which they are a part. They help attract qualified faculty members and promising graduate students because of the research and educational opportunities they make available. They contribute to the pursuit, and achievement, of excellence at the institutions they serve.

S. 2186 is important to the universities. But it also serves a larger purpose. We are often and appropriately reminded that we live in an age that demands a strengthening of the relationships between higher education and industry, that requires a cooperative and mutually beneficial approach to problem solving. That approach serves the interests of society in general and, thereby, of the nation.

It is just such an approach that the minerals research institutes have emphasized and that S. 2186 will expand. The institutes have rallied the mineral resources industry in support of joint research and development efforts and these efforts, in turn, have facilitated the transfer of information between universities and industry.

The bill under consideration today provides incentives to consolidate and increase cooperation and, because it focuses on program quality, it assures that the product of that cooperation will be of higher quality as well.

I will now discuss the changes which S. 2186 makes in the original legislation.

CHANGES MADE TO TITLE III OF P.L. 95-87 AS REFLECTED IN S. 2186

Reauthorization Period

S. 2186 reauthorizes and extends the State Mining and Mineral Resources Research program for five years from FY 85 thorugh FY 89.

The universities view this arrangement as providing a sufficiently long period for program continuity yet also allowing for formal Congressional review after an appropriate time.

Budgetary Changes

The bill reduces authorization for allotment grants from $400,000 in FY 84 to $300,000 in FY 85 and $400,000 in each succeeding year. It also reduces the authorization for research funding from $25 million in FY 84 to $7.5 million in FY 85 to be increased by $1 million per year through FY 89.

We feel that these changes were not made because of reduced program needs but, rather, in recognition of budgetary realities. Naturally, the universities would like to have and believe that they could responsibly use the funds authorized under the original act. However, we are appreciative of the present and proposed future levels of Federal support and agree that such amounts probably represent a reasonable compromise in today's fiscal climate.

The original law required that Federal allotment grant funds be matched by the States on at least a one-to-one basis. The reauthorization bill requires a match of no less than one and one-half non-Federal dollars for each Federal dollar for FY 85 and FY 86 and a match of no less than two non-Federal dollars for each Federal dollar for the remaining three years. The universities view this change as a challenge to the States and to industry to maintain and increasingly share the burden of supporting mineral engineering and science education and research. In many states, non-Federal funding already equals or exceeds the amount that will be needed to provide the increased matching requirement. The proposed change would apply leverage to help assure continuation of that support. In states where non-Federal funding is not now sufficient to meet the proposed increased matching requirement, the change would provide incentive for strengthening of the mineral education and research program through increased state and private support.

Administrative Changes

Title III of P.L. 95-87 provided for an Advisory Committee on Mining and Mineral Resources Research charged to consult with and make recommendations to the Secretary of the Interior on all matters involving or relating to mining and mineral resources research as appropriate to the act. The present bill proposes that the Committee title be changed, slightly, to the Committee on Mining and Mineral Resources Research, that the composition of the Committee be modified to include university participation and the responsibilities of the Committee be broadened. New Committee responsibilities would include:

1. Development of a national plan, by March 1986, for research and development in mining and mineral resources and formulation of a program to implement the plan using resources provided for under the act.

2. Annual updating of the plan described above.

The universities believe that the addition of university members to the Committee will prove to be an important change in that it provides for a means of interchange of information, ideas and attitudes among the three principal parties, government, industry and the universities.

A major problem with the program, in the first five years, has been the lack of a statement of national research needs in mining and mineral resources and of the role that the mineral institutes should play in fulfilling those needs.

While we believe that the institutes have achieved significant and relevant research results, those accomplishments could be much better judged by Congress and by others if the specific goals of the research program were defined in advance. The plan that is required to be developed by the Committee should achieve that objective and the annual updating should show the progress made toward those goals each year.

Eligibility Criteria

The original act specified that, in order for a college or university to be eligible to qualify as a state mining and mineral resources research institute, it must have a school of mines, or division, or department conducting a program of substantial instruction and research in mining or minerals extraction and wherein at least four full-time permanent faculty members are employed.

There has been criticism by Congress and by industry of the number of existing state mining and mineral resources research institutes (31) at least partly because it has been perceived that some of the universities may not have sufficiently strong mineral education and research programs to justify Federal support. The more specific and comprehensive eligibility criteria in S. 2186 should do much to enhance the image of the quality of the state mining and mineral resources research program.

The present bill states that "The Committee shall determine the eligibility of a college or university to participate as a mining and mineral resources research institute under this Act using criteria which include--

(1) the presence of a substantial program of graduate instruction and research in mining or mineral extraction or closely related fields which has a demonstrated history of achievement;

(2) evidence of institutional commitment for the purposes of this Act;

(3) evidence that such institution has or can obtain significant industrial cooperation in activities within the scope of this Act; and

(4) the presence of an engineering program in mining or minerals extraction that is accredited by the Accreditation Board for Engineering and Technology, or evidence of equivalent institutional capability as determined by the Committee."

However, since the introduction of the bill, our continuing review of its provisions has led us to the view that a perfecting amendment is needed on the fourth criteria.

Dr. Swisher will now discuss our proposed change.

AMENDMENT TO SECTION 10

Mr. Chairman and Members of the Subcommittee, my name is James H. Swisher and I am the director of the Coal Research Center at Southern Illinois University at Carbondale, Illinois. One of the programs I direct as head of the Coal Research Center is the Illinois Mining and Mineral Resources Research Institute.

I appreciate this opportunity you have provided me to appear at this hearing to comment on the reauthorization of the Mining and Minerals Resources Research Institute program.

For the past several years, the MMRRI program has enabled universities in 31 states to further their research capabilities in a variety of disciplines related to mining and mineral resources and to greatly enhance their graduate research programs in these disciplines. Although the mineral institute program has experienced some changes since its inception in 1978, when it was under the auspices of the Office of Surface Mining Reclamation and Enforcement, today's mineral institute program, administered by the Bureau of Mines, continues to be an important asset to the universities which house the institutes.

Today, many of the institutes either lead, or are associated with, one of five generic centers nationwide, each of which concentrates on a particular research discipline of mining or mineral resources. However, many of the other institutes not associated with a generic center receive only an allotment grant of $150,000 per year from MMRRI.

Although the amount of the allotment grant is modest and considerably more could be put to good use, I can say with conviction that it has carried an important part of our research and education program at Southern Illinois University. It has provided seed money in research disciplines that are not receiving much Federal support through other programs. As examples, the total research budget for the Office of Surface Mining was supposed to be only $1,000,000 in FY 1984 and not even that amount was actually spent on research projects, and the outside contract research program at the Bureau of Mines has been reduced to a token level. Our allotment grant permitted us to explore several innovative ideas in mining efficiency and the reclamation of mined lands. We are now in a better competitive position to secure follow-up grants and contracts from industry and other Federal sources. One reclamation project funded as a part of the Mineral Institute Program in FY 1979 received $130,000 from the Office of Surface Mining the following year for additional research.

Another important aspect of our and other mineral institute programs is the provision for scholarship and fellowship awards. Several of our students each year would not be able to pursue their degree program on a full time basis without the financial assistance provided by MMRRI.

While the Bill in general provides a good framework for continuation of the Mineral Institute program, Section 10 on Eligibility Criteria has been the subject of considerable review and debate among the mineral institute directors. It is apparent that the intent of Section 10 is to insure that high standards are set for participating universities. High standards should be set, particularly at this time when fiscal restraint in the United States is needed so badly. Our main concern is that none of the existing institutes be eliminated because of a technicality. Of special concern is the manner in which Criterion 4 is stated: "the presence of an engineering program in mining or minerals extraction that is accredited by the Accreditation Board for Engineering and Technology, or evidence of equivalent institutional capability as determined by the committee." Although an ABET accreditation indicates a quality undergraduate engineering program at a particular institution, it says nothing about the quality of its graduate program. Since the MMRRI program places at least as much emphasis on the funding of graduate as undergraduate education, placing excessive emphasis on this accreditation is inappropriate. Furthermore, many of the existing institutions do not have academic departments with mining or minerals extraction in their titles. Their institutional capabilities may come from such departments as geology or metallurgy, or may draw upon capabilities from two or more departments. Consider the example of Southern Illinois University. In addition to our mining engineers, we draw heavily on our Department of Geology in the area of minerals exploration and the School of Agriculture and Department of Botany in the area of land reclamation. Together, these departments provide a strong institutional capability.

Over the past few months, mineral institute directors from the states of Oklahoma, Mississippi, Iowa, Kentucky, Indiana, Ohio, Louisiana, and Massachusetts have worked with Illinois in developing a clarifying change in the statement of Criteria 4 in Section 10. All mineral institute directors concur with this change. This statement should be amended to read, "the presence of an engineering program in mining or minerals extraction that is accredited by the Accreditation Board for Engineering and Technology or evidence of substantial education programs in at least one of the disciplines in mining or mineral resources." (Proposed amendment is underlined.)

Moreover, it should be understood that teaching and research in mining and mineral resources should include, as it has in the past, exploration and recovery of oil, natural gas, coal and non-fuel minerals. The mineral institute directors agree with this philosophy.

By the acceptance of this amendment and the philosophy provided here, universities petitioning for qualification or requalification for the Mineral Institue program will be judged on the quality of their past work, the match between their institutional capabilities and the needs of the program outlined in Section 1(b), and the quality of their proposals for future work. It is these considerations that are all-important and not the titles of academic departments or whether a university's focus is on metal ores, coal or oil.

Dr. Reid will outline for the Committee the history of accomplishments of the Mineral Institutes. Please note the report on accomplishments that accompanies his statement as an appendix. Dr. Reid will also present a statement on the future benefits that we can expect to flow from the continued activity of the Institutes.

HISTORY OF ACCOMPLISHMENTS OF THE MINERAL INSTITUTES

Following the establishment of the Mineral Institutes program in 1977 under Title III of Public Law 95-87, the first eligible institutes were designated in September 1978 and funding began on September 29, 1978.

At the present time (early 1984) there are 31 participating Institutes of which 22 were established in 1978 and have completed five years of operation within the program while the remaining 9 established in 1979 have completed four years.

Data have been collected from all of the Institutes and assembled into a report outlining a five year record of achievement. The report is included as an appendix to the written testimony presented by the University panel.

In introducing the report I will cover only the most signficant highlights and seek to convince the committee that the program has made major impacts in the areas of intent indicated in the original legislation, namely in research and training in the general field of Mineral Engineering. It is pertinent to begin with 3 quotations from a 1969 combined National Academy of Engineering report entitled MINERAL SCIENCE & TECHNOLOGY: NEEDS, CHALLENGES AND OPPORTUNITIES remembering that they were made 15 years ago.

1. "We are alarmed that mineral engineering programs in universities receive so little financial support, a partial consequence of which is the deteriorated state of higher education in the United States."
2. "The country is not running out of mineral resources but out of mineral technology needed for their profitable production and processing in world competition."
3. "The United States must change this trend by incorporating mineral engineering education and research to provide the human resources and the knowledge that alone can prevent an impending serious loss in the country's competitive position in mineral technology."

More recently in a 1980 report on U.S. Minerals Vulnerability, the House Committee on Interior and Insular Affairs, Subcommittee on Mines and Mining urged "Federal departments and agencies to recognize and act upon minerals problems before crisis situations develop" and made recommendations including:

1. "Federal mineral supply research and development should be significantly increased to re-establish United States leadership in technological innovation and to improve recovery and productivity in the minerals sector." and

2. "Increased levels of support should be provided colleges and universities engaged in extractive technologies research."

In 1983 a most important statement of the industrial viewpoint was provided by Donald H. Trautlein, Chairman of Bethlehem Steel Corporation who said to the National Press Club on May 5:

"To compete with the best, you must have the best - the best equipment, the most advanced technology, the most sophisticated techniques and methods - and I think, most importantly, the best-trained people - not by U.S. standards but by world standards."

The introductory quotations serve to emphasize the fact there has been an historical oversight in relation to national needs in minerals education and research, a deficiency which clearly had not been resolved by as recently as 1980 and also that leaders in industry advocate that the generation of world class engineering graduates is of vital importance if we wish to compete internationally.

The Mineral Institute program may be considered a modest start towards addressing these issues and in its first five years has on average supported over 200 research projects per year, over 300 undergraduate students per year and over 400 graduate students per year.

As a result of this support the rate of production of M.S. degrees increased 5 to 6 fold while that of Ph.D. degrees increased 3 to 4 fold. Although these figures indicate a strong response following the creation of the Mineral Institute program the actual numbers achieved leave much to be desired. In particular, for doctoral degrees the average production over the five year period 1978 to 1982 inclusive was 30 per year covering seven different disciplinary areas. This cannot even meet the needs of higher education let alone the needs of industry and government.

The program has received considerable support from industry and a full list of companies and organizations providing direct and indirect support is contained within the report. The list contains over 300 entries.

Financial support from industry for scholarships, fellowships and assistantships exceeds $2 million per year.

In relation to research achievements, although five years is an extremely short period relative to the normal time frame required for basic research, economic assessment, technical development and demonstration and successful commercial application some companies are already using technologies developed under the Mineral Institute program and others are involved in field testing and commercial evaluation programs. Many other projects are in various stages of evolution and examples from each institute are included in the main report. From the assembled data it is clear that the Mineral Institute program has made a significant national impact in accordance with the purpose of the authorizing legislation.

Minerals research has been stimulated in a wide range of topics of national and regional concern and results of this research are already having industrial impact.

Students have been attracted into Mineral Engineering fields and advanced degree production has been signficantly increased.

Cooperative linkages between industry and minerals academic programs are in place.

At a time when the need for faculty support in all areas of science and technology is becoming more commonly recognized the Mineral Institute program provides a response to this problem in one of the areas most critical to the nation, that is, in the minerals sector.

The history of human civilizations has shown that society can exist under a widely divergent range of social, political and technological systems. However, it has also shown that all civilizations are based on the development and use of our earth resources.

It is of vital importance that we do not lose sight of this fundamental fact and equally important that Congress take appropriate action to support the Mineral Institute program which is clearly focused on mineral resource issues.

Expected Benefits

The anticipated benefits of the State Mining and Mineral Resources Institutes, as revised in the proposed bill S. 2186, derive primarily from the substantial contributions that the program will make to education and research in mining and mineral resources field.

The mineral industries are a vital segment both of the national economy and the security and defense of the country. The importance of strategic minerals such as chromium, vanadium, manganese, nickel, platinum, palladium and rhodium to the national defense and security is well known to Congress. The domestic mineral and mining industries supply the raw materials for much of our heavy industries. However, U.S. industries are importing larger quantities of foreign raw materials such as iron ore and bauxite because of price or available supply. The only immediate prospect for redressing this growing imbalance is through upgrading the state of U.S. mining and mineral technology. The keystone of the U.S. economy over the past one hundred years has been abundant, relatively inexpensive supplies of raw materials. These halcyon days are past and now we must use our finite mineral resources more effectively and, through innovations in the technology, devise means of utilizing the increasingly leaner mineral reserves of the continent and nation. This has the potential of maintaining a national competitive margin relative to the production of primary metals, commercial minerals, and industrial feedstocks. The current overdependence on foreign sources for minerals and raw materials can be alleviated by advancing our mineral technologies.

The thrust of the State Mining and Mineral Resources Research Institutes is to conduct programs of applied research that will contribute to mining and mineral industries. The record of the past six years points to many ways the research efforts of these Institutes have had direct benefit to the technology and practice of mineral extraction and recovery. The contributions of the Institutes' research to improved mine safety, productivity and mineral utilization are substantial. In addition there are important contributions from this research to the training of the skilled manpower the industry needs because faculty, staff and students are involved. The involvement of students, particularly graduate students, in this research provides not only an intellectual stimulus but vital training in techniques, solution of problems, and independent inquiry. This research also strengthens the faculty throughout the process by the very nature of this creative enterprise. A benefit of this activity is usually improved teaching at all levels and an assurance that active researchers stay abreast, or in front, of their fields.

Aside from the primary contributions of research and education to the further development and advance of the national mining and mineral resource industries, there are numerous secondary benefits. An important effect will be an increased efficiency of mineral recovery and improved mineral utilization. Such improved practices encourage the conservation of the nation's mineral resources by reducing mineral wastages and inefficiences.

Dr. Sendlein and Dr. Lucas will present their views on the program and particularly its impacts in their own states. (Please note: Dr. Sendlein and Dr. Lucas remarks are contained in separate documents.)

There is attached a statement from the University of Oklahoma concerning the importance of retaining petroleum and natural gas engineering and related sciences in the Mineral Institute Program. This concern is shared with several states and for that reason the university panel has elected to include it here.

We want to identify petroleum and natural gas engineering and related sciences as integral elements of the Mineral Institute program. These disciplines are implied by the emphasis on minerals in the authorizing legislation and it is a fact that petroleum and natural gas are defined legally as minerals. The position of the disciplines in the program has been further substantiated by the original designation of several universities as mineral institutes because of their accreditation and excellence in the field of petroleum engineering.

Petroleum engineering and related sciences contribute both directly and indirectly to the technology of mining and mineral production. Exploration for deep petroleum and natural gas, and their production through boreholes, is a highly developed and specialized mining technology, adaptations of which are commonly used in mining sulphur, salt, and other mineral commodities in the form of brines. Experiments in the mining of coal, copper, uranium and other mineral commodities through boreholes also have been pursued by the mining industry and government agencies.

It is evident that future access to mineral deposits at depths beyond those feasible for human entry will have to be by means other than current conventional mining methods. Specifically, boring may be applied to deep-seated mineral deposits of low grade and large volume and to deposits below the sea floor, as in the intricate and economically successful technology developed by the petroleum industry. Moreover, mineral production through boreholes holds promise for mining mineral deposits in environmentally sensitive areas with far less resulting degradation than with conventional methods of mining.

The nation's technological and academic resources for mining through boreholes are concentrated largely in those institutions that specialize in petroleum engineering and among their graduates who a : employed in the petroleum and natural gas industries. We believe that this positive statement of eligibility for the disciplines in petroleum and natural gas to be part of the Mineral Institute program is the only guarantee of continued benefits to our mining industries from these sources.

a **5** *Year Record of Achievement (1978-1982)*

Increasing Supply and Productivity in the Mineral Sector thru Research and Education

by the Mining and Minerals Resources Research Institutes

Increasing Supply & Productivity in the Mineral Sector through Research & Education

* * *

A Five Year Record of Achievement

(1978 - 1982)

by

The Mining and Mineral Resources
Research Institutes

December, 1983
Washington, D.C.

Dr. Kenneth J. Reid, Director, Mineral Resources Research Center
University of Minnesota, and Chairman,
National Association of Mineral Institute Directors

Dr. Joseph N. Crowley, President University of Nevada, Reno
and Chairman, Mineral Resources Committee
National Association of State Universities and Land-Grant Colleges

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Introduction

The purpose of this report is to provide information to the Congress, the industry, and the Federal government on the accomplishments of the Institutes during the first five years of the Mineral Institute programs. For the program to continue, it must be reauthorized by the Congress prior to the late spring of 1984, and this report will serve to provide background information for that action.

The need for this report was conceived in 1982 by the Mineral Resources Committee of NASULGC, chaired by President Jay Barton, the University of Alaska. It was assembled by a group of Directors, led by Dayne Aldridge, West Virginia University, Chairman of the National Association of Mineral Institute Directors 1983, who prepared the original draft.

It is based on information supplied by the Directors of the thirty-one Mining and Mineral Resources Research Institutes in early 1983. The names and addresses of the directors are included in each of the State Institute Profiles within this report.

The report was printed by the American Mining Congress, through the courtesy of the Mining and Minerals Education Committee, chaired by Jack E. Thompson, president of Newmont Mining Corporation. This Committee has been working closely with the NASULGC Mineral Resources Committee for the last several years.

Background

Mining and Mineral Resources Research Institutes have now been established in 31 states as authorized by Title III of Public Law 95-87 signed August 3, 1977. The purpose of this act is to:

> "stimulate, sponsor, provide for and/or supplement present programs for the conduct of research investigations . . . in exploration, extraction, processing, development, and production of minerals, and the training of mineral engineers and scientists in the field of mining, minerals resources, and technology, and the establishment of an appropriate research and training center in the various states . . ."

The establishment of the Institutes was the outcome of a long-standing concern in the engineering and scientific community. As noted in the report of the National Academy of Sciences in 1969:

> "We are alarmed that mineral engineering programs in universities receive so little financial support, a particular consequence of which is the deteriorated state of higher education in these fields in the United States. We also find an amazing lack of coordination and support of mineral resource research by both federal and state governments as compared with the organization and funding of research on agricultural resources. We find that domestic mineral production as a percentage of the gross national product has fallen off steadily from about 4 percent a decade ago to a present level of about 3 percent, while during the same period the increase in the net value of mineral imports over exports has tripled. The country is not running out of mineral resources but out of mineral technology needed for their profitable production and processing in world competition.
>
> The United States must change this trend by invigorating mineral engineering education and research to provide the human resources and the knowledge that alone can prevent an impending serious loss in the country's competitive position in mineral technology. The U.S. Bureau of Mines must be provided with strong, stable leadership, and this Bureau along with the U.S. Geological Survey should be provided with funds to carry out needed comprehensive research programs (in cooperation with universities, state agencies, and industry) on the science and technology related to our mineral resources."*

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*National Academy of Sciences-National Academy of Engineering, 1969, Mineral Science and Technology: Needs, Challenges and Opportunities. Committee on Mineral Science and Technology.

More recently, in a 1980 report on U.S. Minerals Vulnerability,* the House Committee on Interior and Insular Affairs, Subcommittee on Mines and Mining urged "... Federal departments and agencies to recognize and act upon minerals problems before crisis situations develop." Among the recommendations in the report are these concerning research and development:

"Federal mineral supply research and development should be significantly increased to reestablish United States leadership in technological innovation and to improve recovery and productivity in the minerals sector.

Increased levels of support should be provided colleges and universities engaged in extractive technologies research.

A program should be devised for government to more effectively contribute to demonstration projects to prove new technologies.

The 31 Mineral Institutes established by the Department of the Interior at colleges and universities should be transferred to the Bureau of Mines to improve mineral supply research and development cooperation."

The nation's industrial leadership recognizes and supports research and development leading to the new technologies that are essential to the continuing health and competitive position of the mining industry. For example, David Swan, Vice President of Kennecott Corp in his testimony to a Congressional hearing in 1981 noted that:

> "... with respect to the mining sector, the U.S. appears to be maintaining its preeminent position in the development of mining technology. The tangible benefits of innovation in an industrial society are most clearly shown by improvement of manpower and capital productivity. Thanks to a vigorous U.S. effort, American mining productivity in the nonfuel mineral area continues to show substantial improvement despite a slowdown in recent years."

Donald H. Trautlein, Chairman of Bethlehem Steel Corporation, has emphasized that the development of high-quality human resources is the critical factor in our global economic competition. Speaking before the National Press Club on May 5, 1983, he said:

> "To compete with the best, you must have the best - the best equipment, the most advanced technology, the most sophisticated techniques and methods - and I think, most importantly, the best-trained people - not by U.S. standards but by world standards!"

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*U.S. Minerals Vulnerability: National Policy Implications." Subcomittee on Mines and Mining, Committee on Interior and Insular Affairs. U.S. House of Representatives, November 1980, page 83.

Summary

The Mining and Minerals Resource Research Insitute (MMRRI) program was initiated on September 30, 1978 with 20 institutes and grew to 31 by 1980. The purpose of this federal program was to stimulate research and training of engineers and scientists in mining and minerals resources and technology through the establishment of mining and mineral resource research institutes in states meeting basic qualification criteria.

Despite the relatively short life of the MMRRI program, research conducted under its sponsorship is already yielding practical results and having a positive impact on the nation's mining and minerals industry. Projects involving industry support including field testing and demonstration as well as routine use of research results clearly show the existing and potential industrial impact of this modest sized federal program.

The long term health of the mining and minerals industry in the United States depends on vigorous research activities at institutions of higher education. The stimulation of an average of 234 research projects each year by the allotment program is helping assure future industry vitality by providing research results and student experiences that would not otherwise occur.

Since the inception of the MMRRI program production of advanced degrees production in the mining and minerals disciplines in the United States has shown a 5-6 fold increase in masters degrees and a 3-4 fold increase in doctoral degrees. It is believed that the MMRRI program played a major if not key role in causing this increase since the allotment and scholarship/fellowship programs provided support for a total of 319 undergraduate students and 423 graduate students per year on the average. In addition, 123 students have received support through separately funded research projects.

While the nationwide impact on mining and minerals education is of major significance, the current output of graduates with advanced degrees in Mineral Engineering disciplines is clearly inadequate. The average annual production of 30 PhD's for all extractive minerals disciplines for the whole nation cannot meet the need of new faculty in higher education, much less that of industry and government.

The state Mineral Institutes have benefited from industrial support for both research and instructional activities. Data gathered from the Institutes show a significant level of support for scholarships and assistantships. While access to property and equipment for instructional and research purposes has been provided, direct support for research has been less intense. It is clear that the nation's mining and mineral academic programs interact with industry in ways that complement the mission of the Institute program.

Auxiliary impacts of the MMRRI program include increased continuing education opportunities for industry and improved faculty support. An annual average of 191 faculty received partial or full support through the allotment program helping address an acute instructional problem for mining and mineral academic programs across the nation.

Research: Providing Practical Results

The long term health of the mining and minerals industry in the United States depends upon research and development activities that will provide new information and will lead to new technologies.

Academic institutions are major performers of R&D, and it is critical that the nation maintain vigorous research activities at institutions of higher education. A major purpose of the Institute program is to stimulate research in academic settings.

During the first five years, the Institutes have provided a significant stimulation of research activity. On the average, the Institutes have supported 194 projects each year on a wide variety of mining and mineral topics, throughout the United States. These are research activities that would not otherwise have existed. The program has also contributed over $2.5 million for equipment purchases in support of minerals research.

These activities have already yielded practical results that are having a positive impact on the nation's mining and minerals industry. It would be difficult to estimate the total economic benefit of these accomplishments. But the variety of minerals, the breadth of mining conditions, and the large number of private companies involved, all indicate that the program is having a wide range of impacts.

Here are some examples of the impacts of Institute research:

As a result of research in Alabama on impounded fine coal wastes, fine coal is now being removed by three companies from their waste impoundments and put to profitable use. Plans are underway by several other companies to do likewise.

A system using hydrocyclones was developed for recovery of fine placer gold. Potential users include 450 active placer mines in Alaska.

A complete crystal structure refinement of a kaolinite has been achieved for the first time in Georgia. This leads to the production of a zeolite with an industrial potential of 500 million dollars.

Iowa researchers have found that electroosmosis can be used to enhance the dewatering of coal sludges and suspensions, mill tailings, etc., for recovering useful fuels and minerals from waste products. Tests for possible commercialization are now underway.

Research in Kentucky has yielded methods being used by industry for predicting the effect of mining on an area's hydrology and sedimentology.

Pilot scale and industrial demonstrations have met with success by Michigan researchers on equipment to monitor the ash content of coal using direct on-stream sensors in coal processing plants.

The Mississippi MMRRI delineated 3.3 billion tons of lignite within 300 feet of the surface in Lauderdale County.

Procedures have been developed in Montana for using vibrated high-modulus fills in underground mines. Field testing is underway in the Coeur D'Alene district with economic and safety impacts judged as favorable.

Studies in Pennsylvania have resulted in a major technological process innovation that involves a combination of calcination and sintering phenomena into a single step in the processing of dolomite for refractory applications. This provides a production adaptable process that is both cost and time effective.

Research funded through the Texas MMRRI has pointed to four regions of high potential for deep recovery of lignite.

New methods for mitigating acid mine drainage problems have been discovered and developed in West Virginia. Through the cooperative efforts of the MMRRI, state agencies and industry, field tests are now underway or already in routine use.

The advances in mineral science and technology made possible by MMRI sponsorship serve to foster the initiation of new industrial activity and the improvement of present industrial practice. Further examples of research which has been particularly significant in this regard are included in the State Institute Profiles, later in this report.

Education: Training Quality Engineers and Scientists

Programs which produce degrees in mining and minerals disciplines are the foundation of the Mineral Institute program. There has been national concern over the low production of advanced degrees in science and engineering and especially in the mining and minerals areas. This is not only important to the general health of the nation's minerals' industry but also to the health of the related academic programs.

Data gathered on degree production in minerals related academic disciplines indicates that there has been a significant increase in the production of graduate degrees. The Mineral Institute program has played a major role in this increase. The combined production of the extractive fields increased from 34 to 189 at the masters level and from 11 to 31 for doctorates over the 1978 to 1982 time frame with a high of 46 doctorates graduated in 1981. Data are shown in Table I.

Table 2 shows that the allotment program (under Section 301) has provided support for 99 undergraduates and 185 graduate students each year on the average. Similarly, funds provided for scholarships and assistantships under Section 302 provided support for 220 undergraduates and 238 graduate students per year on the average. Furthermore, research projects under section 302 showed support for 123 students per year. Support for an annual average of 16 post doctorates is also indicated.

The nationwide impact on graduate level mining and minerals education is of major significance. However, the production rate of advanced degrees is clearly inadequate. Table I shows that for the entire United States only 30

TABLE I

Advanced Degree Production in Minerals Related Disciplines

Discipline	1978 MS	1978 PhD	1979 MS	1979 PhD	1980 MS	1980 PhD	1981 MS	1981 PhD	1982 Ms	1982 PhD	Totals MS	Totals PhD
Mining Engineering	8	2	37	3	37	6	41	8	66	5	189	24
Mineral Engineering	1	0	11	2	8	0	8	4	3	3	31	9
Geological Engineering	10	2	35	2	27	2	35	7	27	4	134	17
Metallurgical Engineering	11	6	41	17	33	7	44	16	57	15	186	61
Min. Proc. Engineering	0	0	5	7	6	1	9	2	13	1	33	11
Metallurgy	1	1	7	5	16	4	19	8	11	3	54	21
Mineral Economics	3	0	14	6	7	1	11	1	12	0	47	8
	34	11	150	42	134	21	167	46	189	31	674	151

TABLE 2

Mineral Institute Activity Supported by PL95-87

1978 - 1982

(Average per Year)

Research Projects	234
Faculty Support	191
Student Support	
Undergraduate	
Research Projects	99
Scholarships	220
Graduate	
Research Projects	185
Assistantships	238
Post Doctoral	
Research Projects	4
Fellowships	12
Value of Equipment	$2.5 million

PhD's per year were produced in all extractive minerals disciplines. In mining and minerals engineering alone less than 7 PhD's are being produced per year. These levels of production cannot meet the needs of higher education, much less those of industry and government.

The Industrial Role: A Critical Involvement

The state Mineral Institutes have benefited from industrial support for both research and instructional activities. Data gathered from the Institutes show significant levels of support for scholarships and assistantships, in some States more than $100,000 per year. While access to property and equipment for instructional and research purposes has been provided, direct support for research purposes has been less intense.

Although it is not possible with these data to assess the sufficiency of direct industrial support for the Institutes, the data do show that the nation's mining and mineral academic programs interact with industry in ways that complement the mission of the Institute program. Companies that provide direct or complementary support are listed in the State Profiles that accompany this report. Of the 27 institutes reporting industrial support, the number of separate industrial participants per institute averaged 15.

Here are examples of industrial involvement:

Alabama	- Research on benefication of Eastern Devonian Oil Shales to recover upgraded products; Phillips Petroleum Company.
Alaska	- Analysis for recoverable gold in drill hole samples; Livengood Joint Venture.
Illinois	- Direct support for a wide range of projects plus access to mining properties to perform reclamation research.
Iowa	- Numerous projects relating mostly to coal cleaning.
Kentucky	- At least 45 companies support research involving oil shale, coal liquefaction, fluidized bed combustion and reclamation.
Louisiana	- Six major oil companies support the blow-out training center and associated research.
Michigan	- Direct industrial support for several research projects in mining, metallurgical and geological engineering.
Minnesota	- Post doctoral fellow worked summer 1981 at the Hanna Mining Company's research center collecting data for a study on grinding efficiency and control of a plant grinding mill.
Missouri	- Direct support of projects involving metallurgy, refractory technology, explosives and mining and mineral processing topics.

Montana	- Full support of research concerning tailing ponds for Anaconda Smelter and Butte mining operations at Warm Springs.
Nevada	- Partial support for research on the fundamental chemistry and recovery of gold from carbonaceous ore bodies; Exxon and Westvaco.
North Dakota	- Investigation of the subsidence and surface collapse features in reclaimed surface coal mine spoils.
Oklahoma	- Qualitative and quantitative analysis of iron-bearing minerals in fossil fuels and petroleum source rocks.
South Dakota	- Partial support development of rapid testing methods for coal and coal bearing rocks and study of special blasting techniques.
Utah	- Partial support for development of air sparged hydrocyclone and for research involving monitoring of mine waste dumps, grinding and flotation circuit simulation and use of coal wastes to produce alumina.
Virginia	- Research on the application of image processing for the benefication of fine grained complex sulfide ores has led to full industrial support for using the procedures to study carbonates.
West Virginia	- Full support for numerous projects involving roof control, multiple seam mining, shortwall and longwall mining, fly ash utilization, mine reclamation and coal processing as well as access to surface and underground mines to gather data and perform experiments.

Conclusions

From the data presented herein it is apparent that the Mineral Institute program has made a significant national impact in accordance with the purpose of the authorizing legislation. Without question minerals research has been stimulated in a wide range of topics of national and regional concern and results of this research are already having industrial impact. Students have been attracted to study in these areas and advance degree production appears to have been increased markedly by the program. Industrial linkages to minerals academic programs are in place.

There has been increasing concern over inadequate support for faculty in science and engineering schools across the nation. Mining and mineral programs present some of the most acute problems of this type.

The wide range of benefits is summarized in the State Profiles. Special note should be made of increased continuing education opportunities for industry along with the improved research and instruction facilities including upgraded laboratories. During a time of rapid growth of science and engineering enrollment and reduced state support for higher education, the MMRRI program has provided a critical factor on a national scale for mining and minerals academic programs.

An inadequate supply of qualified faculty, poorly equipped laboratories, etc. are all factors for which the minerals programs must compete for resources within each institution. Thus the 191 faculty (average per year) that have received full or partial support through the MMRRI allotment program has been an important contribution. Although the Mineral Institute program has directed some resources to these problems, the needs continue to exist as does the need for a national base for exploratory research in mining and minerals.

Alabama - Institute Profile
(1978-82)

Director R. Bruce Tippen
Mining and Mineral Resources Research Institute
School of Mines and Energy Development
University of Alabama
University, Alabama 35486

Activities (average number per year):

Research projects	14
Faculty support	14
Student support	
undergraduate	8
Graduate	6

Total Value of Equipment Purchased	$182,117
Industrial Suppport for scholarships, fellowships and assistantships	$79,000

Industrial Impacts:

1. Reconnaissance and Processing of Impounded Fine Coal Wastes

Forty impoundments at 20 sites in the state were sampled and mapped. As a result, fine coal now is being recovered by three companies from their waste impoundments and plans are underway by several other companies to do likewise.

2. Coalbed Methane in Alabama

Four test coreholes, funded by the U.S. Department of Energy, have been drilled to depths of 2800 to 3400 feet. A total of about 200 million cubic feet of gas is potentially available from each forty acre tract in a large portion of the research area. A demonstration well, funded in part by the American Public Gas Association, has been completed on the University campus.

Other Beneficial Impacts:

The Institute provided instructional assistance to the Department of Mineral, Geology and Chemical/Metallurgical Engineering, student employment and equipment purchases in virtually all parts of the university. The publication of results from Institute research on mineral-related activities were important service functions of the Institute. workshops, symposia, conferences, and short courses were conducted on mineral and energy subjects. Attendance was from 100 to 200.

Assistance in solving difficult research and development problems was provided to industry. For example, research studying the impact of surface coal mine blasting on continguous underground operations proved that surface mine blasting, when properly conducted, could be carried out safely in closer proximity to underground operations than allowed by law. Based on the Institute research, the U.S. Office of Surface Mining granted a waiver to the operators permitting a closer blasting scale distance thereby substantially increasing coal production capacity. It is estimated that the modified regulations will permit the recovery of about 20 million tons of coal worth about $500 million which previously was not mineable.

Alaska - Institute Profile
(1978-82)

Director Nolan Aughenbaugh
School of Mineral Industry
University of Alaska at Fairbanks
Fairbanks, Alaska 99701

Activities (average number per year):

Research projects	5
Faculty support	5
Student support	
Undergraduate	24
Graduate	9

Total Value of Equipment Purchased: $49,246

Industrial Impacts:

1. Investigation of Mercury-Antimony-Tungsten Metal Provinces in Alaska

Reexamination of Alaskan deposits indicated that Alaskan mercury-antimony-tungsten should be reevaluated within a stratabound framework. Exploration activity for tungsten in Alaska increased dramatically since the 1979 release of these research results.

2. Application of Hydrocyclones for Recovery of Fine Gold from Placer Material

A system using hydrocyclones was developed and found to be practical in recovery of fine placer gold. The system is designed to be easily disassembled and moved for field installation. Potential users include not only the 450 active placer miners in Alaska but also placer miners worldwide.

Other Beneficial Impacts:

MIRL provides a mining information program in Interior and Central Alaska. A newly constructed 2,000 square foot facility is to be used to display reports, maps, and rocks for the mining community, interested members of the public, and local students. The professional staff and faculty of the School of Mineral Industry pay an annual visit to all high schools accessible by road to deliver talks on the importance of mines and minerals in today's society. Initiated annual Placer conference (1978) with MMRPI funding. Three day MIRL conference (1980) with 600 attendees.

Arizona - Institute Profile
(1978-82)

Director Orlo E. Childs
University of Arizona - MMRRI
Room 17A - Arid Lands Bldg.
845 N. Park Avenue
Tucson, Arizona 85719

Activities (average number per year):

Research projects	4	Student support	
Faculty support	5	Undergraduate	3
		Graduate	12
Post Doctoral	1		

Total Value of Equipment Purchased $107,434

Industrial Support for scholarships, fellowships and assistantships $235,000 per year

Industrial Impacts:

1. Smelter Emission Controls: The Impact on Mining and the Market for Acid

The economic impact of sulphuric acid production at copper smelters was studied. Wide industrial and governmental distribution of the final report has aided in pointing to problems that may result in closing five smelters.

2. Inventory and Hazards Monitoring of Mineral Lands Using Satellite Imagery and Collateral Data

Remote sensing used to assess the environmental hazards of mining operations in Arizona provides an expansive and useful approach to the monitoring of public safety in terms of hazards that must be planned for in continued industrial operations.

Other Beneficial Impacts:

The Arizona Mining Association is directed by Officers of eighteen major Mining Companies, many of whom have headquarters outside the state. A Special Research Report series has been established by the AZ-MMRRI and these reports are distributed to companies through the offices of the Board of Directors of the Association. To date, eight reports have been distributed, and special re-orders have been filled sending the results of research at the University of Arizona throughout the industry, insuring that research activities, and faculty strengths are known within the state and nation.

A special grant of $30,000 was given by the Arizona Mining Association to the College of Mines in support of research at the Dean's direction. These funds made it possible to provide security and reduced operation of a large multi-million dollar research pilot plant given by Univeral Oil Products to the University in support of the College of Mines. This entire facility has been leased to Cimetta Engineering Company with the AZ-MMRRI acting as intermediary to assure research accessibility by faculty and students of the University.

California - Institute Profile
(1978-82)

Director Douglas W. Fuerstenau
University of California
Hearst Mining Building
Berkeley, California 94720

Activities (average number per year)

Research projects	8	Student support	
Faculty support	6	Undergraduate	4
		Graduate	7
		Post doctorals	1

Total value of equipment purchased: $133,700

Industrial support for scholarships, fellowships and assistantships: $329,000 per year

Industrial Impacts:

1. In-Situ Stress in Relation to Mine Stability--Analysis of Keyblocks

This research analyzes conditions for stability of fractured rock mass, which is of concern when an excavation is made into a jointed or fractured rock. In some cases, the movement of one block (the key block) loosens several more behind it so that collapse follows initial rock movements. Procedures have been developed for finding the keyblocks which are central to the stability of the whole excavation. Rigorous, complete, and immediately usable methods have been developed to find all the keyblocks for a surface or underground excavation of virtually any shape. We have demonstrated that it is possible to predict either more-stable-and-less-dangerous or more-ready-to-cave configurations, whichever is preferred.

2. Fluidized Bed Electrowinning of Metals

Fluidized bed electrowinning of metals appears to offer the opportunity for substantially lowering the capital cost of the hydrometallurgical route to copper, nickel and other metals. The implementation of this new technology appears to have been hindered by the fact that most previous investigators of fluidized bed electrodes have encountered cell voltages (electrical energy consumptions) that were much higher than those of conventional electrowinning. The cause of such energy consumptions has been high electrical potentials in the anode side of the cell. Research at Berkeley has led to the development of novel anodes that are free of such excessive energy consumptions, thereby paving the way for commercial development of this improved technology.

Other Beneficial Impacts:

The sharply growing mining activities in California add to the responsibilities of the MMRRI and reinforce its importance to the State. The Berkeley Campus has long had a diverse program in various mineral engineering fields and the Institute has helped provide a focus for faculty teaching and research in these fields. A newly organized mineral engineering curriculum has received full ABET accreditation. The University of California at Berkeley is generally considered to be the overall premiere graduate institution in the United States, and the California MMRRI has influenced the strenghthening of Berkeley's graduate mineral engineering program. Berkeley contributes immensely to publications and symposia in mineral engineering. New faculty in several other colleges and universities received their Ph.D. degrees recently from Berkeley mineral engineering programs.

Colorado - Institute Profile
(1978-82)

Director Joseph C. Weber
Assistant Dean for Research Development
Colorado School of Mines
Golden, Colorado 80401

Activities (average number per year):

Research projects	11
Faculty support	12
Student support	
Undergraduate	2
Graduate	9

Total value of equipment purchased: $16,000

Industrial support for scholarships, fellowships and assistantships: $90,000 per year

Industrial Impacts:

1. Coal Dust Control by Condensation Enlargement

The objectives of the research were to design, construct, and evaluate a prototype dust conditioning system based on the concept of condensation enlargement. (Funds by NIOSH, CSM, and industry.)

2. Mineral Beneficiation and Extractive Metallurgy

The overall research program is related to the applications of surface chemical principles to mineral beneficiation and extractive metallurgy. Current development efforts include the following: (1) control of critical surface tension of wetting in flotation; (2) the surface chemistry of particles finer than 50 microns, obtained at controlled temperature; (3) filtration and dewatering of coal fines; (4) beneficiation of oil shale prior to retorting; and (5) non-bauxitic alumina and low-grade chrome-ore beneficiation. (Funds by CSM and industry.)

Other Beneficial Impacts:

The Mineral Institute is an integral part of CSM's program for Graduate Studies and Research and has demonstrated its effectiveness in developing and conducting research and the training of engineers and scientists. In a more recent year (1982-83), over 130 graduate degrees in mineral science and engineering related fields were awarded.

In a $5-6 million research program, the largest single sponsor group is private industry which accounts for over 25 percent of the award volume. The second and third place sponsors are the Departments of Energy and Defense which each account for some 20 percent of the volume.

Institutes and centers focus much of the CSM research activities. The range of interests in this type of development span the campus and are closely identified with the needs of the minerals and energy industries. Titles of ongoing institutes include Earth Mechancis Institute, Center for Welding Research, BoM Generic Center for Comminution (Utah), Mined Land Reclamation Group (Colo. St. Univ.) and the Center for Potential Field Studies.

Georgia - Institute Profile
(1978-82)

Director John E. Husted
Georgia Mining and Mineral Resources Institute
Georgia Institute of Technology
Atlanta, Georgia 30332

Activities (average number per year):

Research projects	1
Faculty support	1
Student support	
Undergraduate	1
Graduate	1

Total value of equipment purchased: $110,073

Industrial Impacts:

Structural Location and Role of Hydrogen Ions in Kaolinate and Its Products in Aluminum Removal

A complete crystal structure refinement of a kaolinite has been achieved for the first time. Leaching studies of calcined kaolinite include first attempts at producing a zeolote as a by-product. Possible new industrial potential of 500 million dollars has been identified.

Other Beneficial Impacts:

The Mineral Institute program has had a definite positive impact both at Georgia Tech and within the state. The areas of impact are as follows:

1. Georgia Tech. The Mineral Institute has bolstered the mineral engineering program and encouraged the administration to proceed with an enlarged offering.

2. It has garnered industrial support and brought officers of the Georgia Mining Association and key mineral industry administrators within the State of Georgia together to back a minerals engineering program of research and education at Georgia Tech.

3. Industrial research is starting to come to the Institute.

Idaho - Institute Profile
(1978-82)

Director George A. Williams
College of Mines
University of Idaho
Moscow, Idaho 83843

Activities (average number per year):

Research projects	4
Faculty support	3
Student support	
Undergraduate	1
Graduate	5
Post-doctorals	0.2

Total value of equipment purchased:	$39,161
Industrial support for scholarships, fellowships and assistantships:	$60,000/year

Industrial Impacts:

1. Fracture Control of Coeur d'Alene Ore Deposits, R.R. Reid and W. B. Hall

This research emphasizes the reconstruction of a structure model based upon detailed field mapping carried out both on the surface and underground. With the information, a palinspastic reconstruction of the structural geology of the mining district has been prepared. The model points toward regional-stratigraphic and structural control for the ore deposits. In addition, it is felt that the ores are localized within close proximity to the Lewis and Clark shear zone.

2. Legal Pitfalls, Land Status and the Acquisition of Mineral Rights, Olen P. Matthews

Increased mineral demands have made mineral development within the United States an important issue. This is at a time when the economic and legal variables that influence mineral development have been changing rapidly. The issue is extremely important on federal lands in the western states. Changing the laws that applies to these lands, changes the potential for development. Recent laws have been passed which have withdrawn land from development or have severely restricted the use of the land. There is a need for developers to understand how the laws related to status affect mining development. This monograph is a step toward determining the relationship between the legal system, and the acquisition of mineral rights. The monograph has been in demand from most legal companies and law colleges.

Other Beneficial Impacts:

The Idaho MMRRI has been influential in supporting the needs of the mineral industry in the state. Metallurgical techniques developed through support of the institute is now in the production stage in several mills in the state. The support of a seminar in Geography related to the mineral industry brought in numerous experts to teach students and expand the offerings within the college.

Illinois - Institute Profile
(1978-82)

Director James Swisher
Coal Research Center
Southern Illinois University at Carbondale
Carbondale, Illinois 62901

Activities (average number per year):

Research projects	8	Student support	
Faculty support	7	Undergraduate	2
		Graduate	7
		Postdoctorals	0.6

Total value of equipment purchased: $51,356

Industrial support for scholarships, fellowships and assistantships: $9,000 per year

Industrial Impacts:

1. Coal Fines Recovery and Utilization

A process for recovery of energy from waste coal fines was developed through laboratory, bench, and pilot plant scale experiments. It consists of mechanical cleaning followed by high temperature oil agglomeration of pelletization. The process can produce a quality product under an economically and environmentally acceptable condition.

2. Productivity of Parent Materials on Mines Prime Farmlands

Still in process, the intent of this study is to evaluate reclamation methods using different parent materials for B horizon replacement and organic amendments for topsoil replacement at a reduced cost while still maintaining or improving the food-producing potential of the mined soil. Selected parent materials are being evaluated as rooting media for corn and soybeans. The results will aid in reducing reclamation costs, energy consumption, and the time required to properly reclaim mined prime farmland.

Other Beneficial Impacts:

One of IMMRRI's priorities has been the funding of reclamation research. Over the past four years, IMMRRI has awarded sixteen program development "starter" grants in the reclamation area. Arising from this emphasis on reclamation, IMMRRI, along with the Coal Research Center at SIUC, have been sponsors of the annual Midwest Reclamation Tour. For two days, sixty to a hundred individuals from industry, government, and academic institutions tour strip mined lands in Illinois, Indiana, Kentucky, and Iowa. Reclamation practices at mine sites in these areas are examined.

The reclamation emphasis also led to the Department of Energy's funding of the 1983 Coal Research Center's publication, The Surface Mining Environmental Monitoring and Reclamation Handbook. This Handbook furnishes coal mine operators with cost-effective techniques for compliance with monitoring requirements of the Surface Mining Control and Reclamation Act.

Largely through IMMRRI-funded preliminary studies, faculty members have received several contracts from coal companies for research on mining efficiency, mine safety, and subsidence prevention.

Indiana - State Profile

(1978-82)

Director Donald W. Levandowski
Geosciences Building
Purdue University
West Lafayette, Indiana 47907

Activities (average number per year):

Research projects	5	Student support	
Faculty support	5	Graduate	10
		Postdoctors	0.4

Total value of equipment purchased: $ 35,000 (Federal)
$400,000 (Non-Federal)

Industrial Impacts:

1. Dispersion Stability and Rheology of Bauxite Tailings

A major issue facing the mineral processing industry is the transportation and disposal, or further utilization of mineral tailings. Tailings from alumina production, known as "red muds," are produced at 10 million tons per year. Because these tailings are quite toxic, they must be isolated indefinitely. Moreover, red muds contain potentially usuable materials, such as iron oxide, titanium oxide, sodium hydroxide, and additional alumina. An understanding of the flow characteristics of the tailings is required to develop economically feasible processing technologies for separating the useful materials and concentrating the remaining waste into a compact solid form.

2. Simulation-Optimization Model for Exploration and Exploitation of Exhaustible Mineral Resources

The objective of this research was to develop a computer model of the exploration and exploitation processes for mineral resources. The use of simulation models with imbedded optimization modules provides mineral industry firms with powerful mathematical techniques which can be used as evaluation tools.

3. Slope Stability Relative to Coal Mining in the Illinois Basin

Slope stability studies are underway for open pit coal mines where lake bed clays occur at the earth's surface. Failure in the cast over piles or in the cut face cause costly delays in the mining process. In another study, the instability of selected roof areas of an underground coal mine are being evaluated using geophysical logs obtained during coal exploration. Prediction of these roof fall areas may be possible on the basis of the logging data obtained during the exploration and development of the coal body.

Other Beneficial Impacts:

Cooperation with several mining companies nationally and in Indiana and Illinois has been achieved through these IMMRRI supported research projects. The Department of Natural Resources of Indiana has also participated in projects with IMMRRI. Practical problems of interst to mining companies or to the state agencies are selected which provide valuable training for students who work on real life problems.

Iowa - Institute Profile
(1978-82)

Director Ray W. Fisher
Iowa State University
Room 321 Spedding Hall
Ames, Iowa 50011

Activities (average number per year):

Research projects	12	Student support	
Faculty support	10	Graduate	12
		Undergraduate	1

Total value of equipment purchased: $68,000

Industrial support for scholarships, fellowships and assistantships: $32,000 per year

Industrial Impacts:

1. Coal Preparation Research Facility at Iowa State University

Our facility evaluates and develops coal preparation processes to aid in preparation plant design, and to prepare specification coals for new application. Operation of the facility has resulted in the commercial design of a heavy-media vessel, of which 19 have already been sold (sales of approximately $5,000,000). Two commercial coal preparation plants costing over $3,000,000 each, have come into being in the State of Iowa as a result of this work, and several commercial processes have been modified. Researchers (students) have taken supervisory positions in the mineral industry.

2. Dewatering of coal and mineral sludge by pressurized electroosmosis

Electroosmosis can be successfully used to enhance the dewatering of coal sludge, coal suspensions, sewage sludges, mill tailings, slimes, pulps, and other materials which are difficult to dewater. This method is useful in the prepartion of specialty fuels and minerals from waste materials. It is currently being tested for possible commercialization.

Other Beneficial Impacts:

Developed a patentable safety device to test rock strength and a method to measure in-situ stress in underground mine workings, an industrial process to recover iron ore from power plant fly ash, an electrowinning method to recover copper from aqueous solutions by means of a fluidized bed electrochemical reactor, and a method to determine the concentration changes during the dissolution of a uranium dioxide-pyrite mixture with application to leaching uranium ore from the ground; operated successfully a surface coal mine, processed over 100,000 tons of coal by conventional and experimental beneficiation methods, and restored the strip-mined land to a higher level of agricultural productivity; stimulated the formation of a new interdepartmental graduate minor in mineral resources and expanded the number of courses offered in such areas as mining methods, mineral processing, reclamation of mined land, industrial minerals, extractive metallurgy, and coal science and technology; attracted over $125,000 for cooperative research under ISMMRRI direction and over $900,000 additional funds into Iowa State University for research addressing mining and mineral-related activities.

Kentucky - Institute Profile
(1978-82)

Director Lyle V. A. Sendlein
Institute for Mining and Minerals Research
321 Patterson Office Tower
University of Kentucky
Lexington, KY 40506

Activities (average number per year):

Research projects	7	Student support	
Faculty support	10	Graduate	16
		Undergraduate	10 (Additional 60 per year from matching state money)

Total value of equipment purchased: $92,891

Industrial support for scholarships, fellowships and assistantships: $45,000 per year

Industrial Impacts:

1. Hydrology and Sedimentology of Surface Mined Lands

A reasonable prediction of the effect of mining on an area's hydrology and sedimentology can now be made. The size of a sediment pond needed to be constructed to meet a given effluent standard can also be predicted.

2. Mining Engineering Continuing Education

The program provides continuing education for practicing engineers and related professionals serving the mining industry and assists them in implementing the Surface Mining Control and Reclamation Act. Since 1978 the Office for Informational Services and Technical Liaison at the IMMR and the Engineering Continuing Education Office have conducted more than 150 short courses, seminars, workshops and symposia with more than 5,000 attendees.

Other Beneficial Impacts:

Since the 1972-1973 academic year, the IMMR has received $38,579,530 to conduct the Coal and Mineral Research and Development Program for the Commonwealth of Kentucky at the Kentucky Center for Energy Research Laboratory. The primary factor for the University being selected as the contractor to operate this government-owned, contractor-operated laboratory was the existence and activities of the IMMR, and the commitment exists on behalf of the Commonwealth that the IMMR will continue to operate the KCERL. The impact of becoming a Title III Institute has resulted in increased growth in the R&D program beginning in 1978 when the appropriations for the Laboratory program from the Commonwealth approximately doubled. Conducted 153 short courses, seminars, workshops and symposia (1978-82), treating topics such as "Stability Analysis," "Permitting Procedures," "Surface Blasting Certification," "Hydrology and Sedimentology of Surface Mined Lands," "Sediment Pond Design," "Kentucky Coal Refuse Disposal" and "Public Law 95-87, Surface Mining Control and Reclamation Act."

Louisiana - Institute Profile
(1978-82)

Director Ralph W. Pike
Mining and Mineral Resources Research Institute
Office of Research
Louisiana State University
118 David Boyd Hall
Baton Rouge, Louisiana 70803

Activities (average number per year):

Research projects	8
Faculty support	10
Student support	
Undergraduate	2
Graduate	4
Postdoctoral	0.4

Total value of equipment purchased:	$89,000
Industrial support for scholarships, fellowships and assistantships:	$60,000 per year

Impacts:

In minerals extraction research on diagenetic evolution of porosity in carbonates, isotopic analysis has shown very distinct patterns with regard to changing isotopic compositions in Pleistocene carbonates, and these results have been reported in research papers at meetings of the Geologic Society of America. In the study of enhanced recovery of oil using carbon dioxide, the equilibrium phase behavior has been correlated from laboratory experiments on the solubility of carbon dioxide in crude oil.

In the computer-graphics an interactive program is operational and is being used on mineral resources data bases to display statistical and geological data in a pictorial form. In minerals processing research a comparison of standard minerals processing computer-aided design programs has been completed for the two standard mineral industry processes with the results being presented to industry in publications and seminars. In optimizing the combustion characteristics of lignite and fuel oil the sonic burner configuration has been demonstrated to be superior to other designs, and work is proceeding to evaluate lignite - water mixtures in this burner.

In economic, legal and business research the cooperative project with the Mineral Law Institute has completed a thorough search of recent litigation associated with tax sales of property and the transfer of mineral rights with these sales. Recommendation for legislation have been made to clarify the confusion that now exists in these sales. In economic projections a definite impact on the petroleum industry in the Gulf coast of the initiation of production of petrochemical products in the Middle East in 1985 showed compensating factors replacing lost markets. Environmental impact studies of fly-ash from lignite show essentially no major contamination from leachates under acid rain conditions.

Massachusetts - Institute Profile
(1978-82)

Director John F. Elliott
Mining and Minerals Resources Research Institute
Room 4-140
Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, Massachusetts 02139

Activities (average number per year):

Faculty support	8
Student support	
Graduate	4

Total value of equipment purchased:	$77,357
Industrial support for scholarships, fellowships and assistantships:	$279,000 per year

Industrial Impacts:

1. Remote Control Mining Programs

This study and research is directed to evolutionary change in mine design and mining operations for underground mining of coal. A long term objective is to remove personnel from the most dangerous area, the work face, and simultaneously increase the productivity of the operation. As the program progresses, spin-offs of innovative sensing methods and designs should be forthcoming.

2. Process Metallurgy Programs

A very active program of modelling turbulent conditions in the liquid phases in smelting and refining operations provides means of characterizing parameters relating to heat and mass transport in industrial scale operations.

Other Beneficial Impacts:

The MMRRI Program and the Institutional Grant are being employed to encourage interest in mineral related teaching and research activities at MIT. Three research programs were established recently, the Remote Control Mining Program, the Underground Fracture Program and the REMERGENCE Laboratory (Resource Extraction, Materials and Energy, Reservoir, Geotechnical, ENvironmental, and Construction Engineering). These programs are now free standing, but have received support in various ways from MMRRI funds. MMRRI funds have also been instrumental in reestablishing the program in Mineral Engineering at MIT. Funds from the institutional grant are employed to support both faculty and graduate students with ideas for innovative research programs.

Michigan - Institute Profile
(1978-82)

Director Lloyd A. Heldt
Center for Mining and Mineral Resources Research
Michigan Technological University
Houghton, Michigan 49931

Activities (average number per year):

Research projects	11
Faculty support	4
Student support	
Undergraduate	4
Graduate	4

Total value of equipment purchased:	$62,000
Industrial support for scholarships, fellowships and assistantships:	$70,000

Industrial Impacts:

1. Micro Froth Flotation

Research on the use of micro froths for flotation of fine ores, including Michigan iron ores, has attracted significant industrial interest and support. Bench scale tests and computer modeling of the process evidence high efficiencies.

2. Economics of Underground Vs. Surface Mining

The impacts of increased energy costs were analyzed. Industrial interest has resulted in wide distribution of this report.

Other Beneficial Impacts:

1. Elastic Stress Wave Propagation in Underground Mining

This research has provided valuable new information which is employed in analyzing the deterioration of mine structures caused by repeated explosive blasting.

2. Development of Control Systems for Coal Processing

Sensors and computer software were developed to monitor ash content of coal on-stream in coal processing plants. The project has progressed to pilot scale and industrial demonstrations with success. Significant increases in coal processing efficiency should result.

3. Development of Guidelines for Closing Underground Mines

Deficiencies in mine closures were documented. Subsidence, shaft failures, acid or toxic water damage are included. Remedial measures are recommended following field studies in coal producing and metal product~~ive~~ ing areas.

Minnesota - Institute Profile
(1978-82)

Director Kenneth J. Reid
Mineral Resources Research Center
University of Minnesota
56 East River Road
Minneapolis, Minnesota 55455

Activities (average number per year):

Research projects	4
Faculty support	1
Student support	
Graduates	7
Undergraduate	2
Postdoctoral	2

Total value of equipment purchased: $77,357

Industrial support for scholarships, fellowships and assistantships: $56,000 per year

Industrial Impacts:

1. Chemistry and Mineralogy of Cementitious Materials

Novel cements can be made in a plasma reactor. This opens up the possibility of a range of nonconventional materials tailored to particular objectives. The economic impact of this work could be very large in the basic cement/concrete industry.

2. By-product Recovery from Copper-Nickel Bearing Duluth Gabbro

A low-grade copper-nickel deposit (averaging 0.6% copper and 0.2% nickel) estimated at 4.6 billion tons, occurs in northeastern Minnesota. This project provides basic information on process economy and resource conservation through by-product recovery and on environmental protection through removal of potentially hazardous components in the tailings.

Other Beneficial Impacts:

The dedicated Computer Interactive Graphics Facility for Undergraduate Syntheses and Systems Analysis Laboratory is being used to introduce design and systems concepts to undergraduate mining engineers. Special purpose computer software was developed for a PDP 11/60 mini-computer with Tektronix terminals and the use of this software was integrated into undergraduate courses. Software packages included linear programming, critical path scheduling and a truck-shovel simulator.

A major result of the establishment of the laboratory has been a complete reorganization, over two years, of a senior course in mine systems analysis. The entire course is now built around the computer laboratory.

The laboratory facilities have been used to encourage development of software suitable for undergraduates. One development is aimed at replacing lectures in geostatistics by a series of exercises on the computer.

Mississippi - Institute Profile
(1978-82)

Director J. Robert Woolsey
University of Mississippi
Mineral Resources Institute
University, Mississippi 38677

Activities (average number per year):

Research projects	22
Faculty support	4
Student support	
Undergraduate	3
Graduate	14

Industrial Impacts:

Wilcox Lignite Study

3.3 billion tons of lignite within 300 feet of the surface were delineated in Lauderdale County, Mississippi.

Other Beneficial Impacts:

Offshore Heavy Mineral Program: Provided support for a sub-bottom profiling and grab sampling survey of offshore Mississippi waters, which determined the occurence of considerable surficial concentrations of high grade TiO_2 and ZrO_2 minerals, as well as significant amounts of high grade refractor minerals.

Zeolite Project: Provided funding for a preliminary field and drill sampling investigation of considerable quantities of clinoptilolite in southeast Mississippi.

Developed information dissemination system through a newsletter; sponsored lignite seminar.

Missouri - Institute Profile

Director David J. Barr
School of Mines and Metallurgy
University of Missouri-Rolla
112 Mining Building
Rolla, Missouri 65401

Activities (average number per year):

Research projects	7
Faculty support	7
Student support	
Undergraduate	4
Graduate	17

Total value of equipment purchased: $127,000

Industrial support for scholarships, fellowships and assistantships: $173,000 per year

Industrial Impacts:

1. Digital Data Base for Coal Mine Subsidence

This research project demonstrated the usefulness of merging engineering and geological data by means of digital image and map processing. Coal mine subsidence was correctly predicted within the study area and correlated with surface land use.

2. Studies of Atmospheric Fogging in Underground Mine Airways

University and Industry personnel worked cooperatively to seek solutions to fogging problems in a mine in the Missouri Lead Belt.

3. Effect of Pelletization on the Sintering of a Lead Charge

This cooperative research with industry led to a Ph.D. dissertation containing recommendations for attaining increased lead processing and smelting efficiency.

Other Beneficial Impacts:

The Missouri Mining and Mineral Resources Research Institute has stimulated activity within all disciplines of the School. Recent technology transfer activities include symposia on Rock Mechanics, Water Jet Technology, Remote Sensing and Digital Data Bases, Ore Microscopy, Electro-metallurgy, Mississippi Valley Type Lead-Zinc Deposits and Characterization of Missouri Coal.

The MMRRI program has supported the initiation of research for 7 Ph.D. candidates during this past year. In each instance the nominal financial assistance has allowed the students to organize their respective research objectives, initiate the research and seek additional funding from external sources when necessary. Also, several laboratories have been upgraded and support has been provided for newer faculty.

A major effort has been undertaken to procure microcomputers for use in classroom instruction and research. Microcomputer applications are now being integrated into most courses with a considerable benefit to our students.

Montana - Institute Profile
(1978-82)

Director Edward C. Bingler
Montana College of Mineral Science & Technology
Butte, Montana 58701

Activities (average number per year):

Research projects	1
Faculty support	1
Student support	
Undergraduate	1

Total value of equipment purchased:	$128,917
Industrial support for scholarships, fellowships and assistantships:	$240,000 per year

Industrial Impacts:

1. Projection of Coal Demand from the Northern Great Plains through the year 2010

This study was based on an economic model of the spatial markets and updates an earlier study. The Powder River Basin represents the largest pool of underdeveloped leased Federal coal land in the United States and presently accounts for about half of all Federal coal production. The scale and timing of production is clearly tied to Federal reclamation and leasing policy. The model indicates that future production will be tied to demand for electricity in the market area.

The report has been requested and studied by persons in government and industry since the economy of the region will be vitally affected by future coal development.

2. Vibrated High-Modulus Fills in Underground Mines

Procedures were developed for emplacing and testing fills of mine and mill tailings. Application of the results in underground mines in the Coeur D'Alene district has been subject of further work, interrupted by strikes. The technological/economic impact is evaluated as favorable and there is a favorable safety impact.

Other Beneficial Impacts:

One benefit that must be mentioned is that mineral institute funding enabled the establishment of technical support areas for electronics and machine shop facilities. These were not previously available on campus. Both facilities are now operating and are now close to self-supporting so that all mineral institute financial support can be withdrawn within about a year. Presently about 25% support is provided. The establishment of these service support areas has definitely strengthened our research capabilities as well as out instructional program. Short courses on Ventilation (1979 and 1981) and publication on Mineral Processing.

Nevada - Institute Profile
(1978-82)

Director James L. Hendrix
Mackay School of Mines
University of Nevada at Reno
Reno, Nevada 89557

Activities (average number per year):

Research projects	5
Faculty support	3
Student support	
Undergraduate	20
Graduate	11

Total value of equipment purchased:	$55,000
Industrial support for scholarships, fellowships and assistantships:	$60,000 per year

Industrial Impacts:

1. Recovery of Copper, Arsenic, Bismuth & Antimony from Copper Smelter Slag Wastes

Copper slag was reduced with carbon to yield metals listed above. The research results served to increase metals recovery from industrial wastes.

2. Studies Concerning the Metallurgy of Gold

Multiple studies associated with the hydrometallurgy of gold. Studies evaluating hydrometallurgical methods for recovery of gold from ores have been conducted. Also, studies concerning the fundamental chemistry of gold within carbonaceous ore bodies, as well as evaluation of carbons for the use in the carbon-in-pulp circuits have been studies.

Other Beneficial Impacts:

Other beneficial impacts of the MMRRI program include: Leverage with industrial concerns for fund raising activities; enhancement of campus, state and industry perception of Mackay School of Mines; travel opportunities for faculty and students to professional meetings; enhanced recruiting opportunities.

Of special note is the flexibility in research that our long time established School of Mines has gained by the use of research assistantships and fellowships funded by MMRRI monies. New Ideas can be pursued, as well as new faculty assisted in establishing their research program, by the availability of MMRRI fellows.

New Mexico - Institute Profile
(1978-82)

Director Arpad E. Torma
New Mexico Institute of Mining and Technology
Campus Station
Soccorro, New Mexico 87801

Activities (average number per year):

Research projects	11
Student support	
Undergraduate	8
Graduate	5

Total value of equipment purchased: $84,702

Industrial support for scholarships, fellowships and assistantships: $115,000 per year

Industrial Impacts:

1. Radionuclides and Heavy Metal Distribution

Project aim was to determine extent to which uranium mining activity in the Grants Mineral Belt of New Mexico contributed excess trace minerals to sediments in that area during the last 30 years. Various dating methods including gamma ray spectrometry are used. The cost to clean up uranium processing spills is immense since it is difficult to distinguish between debris from the spill and naturally occurring material. Application of this technique could reduce cleanup costs significantly.

2. Gases in Hydrous Minerals

An exploration tool for ore deposits, the project determined gas content of hydrous minerals could be used as an exploration indicator for ore deposits. A firm has been organized to perform this kind of analysis.

Other Beneficial Impacts:

The Mineral Institute at New Mexico Institute of Mining and Technology (NMIMT) is organized to assume an important role in the mineral-oriented research and educational training and to strengthen the mission of NMIMT. In many instances, the Mineral Institute provided money to hire new faculty with distinguished records of research. These experts in addition to their educational contribution, help solve problems of concern to New Mexico's petroleum, mining and metallurgical industries. Undergraduate scholarships, graduate and postdoctoral fellowships were awarded to outstanding candidates, who, on the basis of these awards, often made their career choice to stay with the mineral industries. Further research activities were initiated by providing "seed" money for trying out new promising ideas which could lead to the development of an important project, as capital equipment was purchased which improved the NMIMT research capabilities. The members of the Mineral Institute have participated in workshops, congresses and short courses of national and international importance.

North Dakota - Institute Profile
(1978-82)

Director Gerald H. Groenewold
Mining and Mineral Resources Research Institute
Box 8103 University Station
Grand Forks, North Dakota 58202

Activities (average annual number per year):

Research projects	7	Student support	
Faculty support	3	Undergraduate	8
		Graduate	5
		Postdoctorals	0.2

Total value of equipment purchased: $114,000

Industrial support for scholarships, fellowships and assistantships: $27,000 per year

Industrial Impacts:

1. Mineral Resources and Potential Problems Associated with Mining of Cenozoic Rocks of the Williston and Powder River Basins, Northern Great Plains

This study represents the first detailed regional evaluation of the coal-bearing strata of the Ft. Union Region. As such it provides the basis and necessary data for designing exploration programs, predicting mining design problems and predicting the impacts of mining on the environment.

2. Cooperative Program to Evaluate Surface and Groundwater Problems Associated with Stripmine Sites

Two modeling efforts have been completed. The groundwater response model predicts mining impacts on ground water and, in turn, has been used as an aid in the design of mining operations. The hydro-geochemical model is capable of predicting the hydrochemical impacts of surface mining in various settings.

Other Beneficial Impacts:

The improved relationship, since the MMRRI was funded, between the industrial and academic communities in North Dakota has been striking. There has been a growing commitment to support and cooperate on various research topics. The mining and energy resource companies have become actively involved in the design of our academic programs and have provided industry personnel for teaching. The mining engineering curriculum has been significantly expanded and a new faculty position in mining engineering has been filled utilizing MMRRI funds. The MMRRI program has resulted in a significant increase in student enrollment in the mining engineering curriculum and has influenced both faculty and students to pursue research related to mining and mineral resources. The North Dakota mining industry agreed to annual support 18 undergraduate summer workstudy positions. MMRRI funds have been utilized to provide equipment and personnel for the Natural Materials Analytical Laboratory (NMAL). The NMAL is a modern analytical laboratory that is designed to promote mineral-related research and education. NMAL equipment includes a scanning electron microscope and microprobe, x-ray diffraction and x-ray fluorescence. Completion of the NMAL places the North Dakota MMRRI in a highly competitive position to pursue mineral and energy resource-related projects and greatly facilitates the training of students in mineral and mining programs. During the two year period, 1980-1982, three short courses and two seminars were conducted.

Ohio - Institute Profile
(1978-82)

Director Calvin J. Konya
Ohio State University
233 Koffolt Labs
140 W. 19th Ave.
Columbus, Ohio 43210

Activities (average number per year):

Research projects	18
Faculty support	13
Student support	
Undergraduate	2
Graduate	5
Postdoctoral	1

Total value of equipment purchased:	$108,649
Industrial support for scholarships, fellowships and assistantships:	$60,000 per year

Industrial Impacts:

1. Bacterial Desulfurization of Coal

A unique process of sulfur removal has been developed at the Ohio Institute. This process will remove up to 95% of pyritic sulfur and as much as 70% of the total organic and pyritic sulfur and sulfate from Ohio coals. The process functions at a rate four times faster than any previously reported.

2. Control of Airblast and Excessive Ground Vibration by Use of Efficient Stemming

The object of this research was to determine how stemming functions in a borehole and the parameters which could be used to reduce unwanted effects from the blasting. The study was the first ever to directly measure borehole pressure. The study defined methods by which airblast and ground vibration from blasting could be minimized.

Other Beneficial Impacts

The Ohio Institute played a vital role in focusing attention on minerals research at The Ohio State University and at other universities within the State. The program has encouraged minerals research by offering minerals fellowship assistantships and "seed money" for new and innovative research through an initiation grants program. The State has responded by including a line item of $400,000 per year to be used in coal research. As a result of the Institute program, research activities in the minerals area has dramatically increased over that which existed before 1978. Many new minerals faculty have been hired, and a graduate program in mining engineering has been established.

Oklahoma - Institute Profile
(1978-82)

Director Robert H. Arndt
University of Oklahoma
830 Van Vleet Oval - Room 163
Norman, Oklahoma 73019

Activities (average number per year):

Research projects	6
Faculty support	5
Student support	
Undergraduate	2
Graduate	7
Postdoctoral	0.2

Total value of equipment purchased: $97,800

Industrial Impacts:

In Situ Mining of Bituminous Coal

A method was developed which is now being applied in an attempt to convert Oklahoma Waste Coal to Asphalt. The conversion project is sponsored by the state of Oklahoma.

Other Beneficial Impacts:

In the past two years exposure to OMMRRI and assistance supplied by OMMRRI has nurtured interest in rock mechanics for two professors in Aerospace, Mechanical and Nuclear Engineering. The immediate thrust is toward problems in oil recovery. This new interest has attracted at least 3 graduate students. AMNE considers this to be a strong upgrading of departmental offerings. Support has been given to a new professor in the School of Chemical Engineering during the last two years to assist in the establishment of engineering research in the field of enhanced recovery of oil. The new programs in AMNE and CEES complement a well established basic research program in enhanced recovery of oil in the Department of Chemistry. The latter program addresses the relationships between surfactant, fluid and mineral grains, and the solubilization of hydrocarbons. Mutual interests among the investigators have led to fruitful discussions and informal linkage of efforts between the College of Arts and Sciences and the College of Engineering.

A core-drilling campaign to evaluate resources of heavy oil and tar sands in the Arbuckle Mountains of south-central Oklahoma has been pursued by the Oklahoma Geological Survey for more than a year. OMMRRI provided a respectable increment of the purchase cost of the drilling rig used by the Survey. Sponsored 3-week energy field course (1979); $26,500 used to purchase technical literature, collect Oklahoma mineral industry news and items needed by Petroleum and Geological Engineering departmental libraries (1979-83).

Pennsylvania - Institute Profile
(1978-82)

Director Z. T. Bieniawski
Pennsylvania State University
110 Mineral Sciences Building
University Park, Pennsylvania 16802

Activities (average number per year):

Research projects	7
Faculty support	8
Student support	
Undergraduate	3
Graduate	12

Total value of equipment purchased:	$78,904
Industrial support for scholarships, fellowships and assistantships:	$81,200 per year

Industrial Impacts:

1. Factors Controlling the Generation of Acid Mine Drainage

Based on laboratory tests and field work in western Pennsylvania, relations between acid drainage, pyrite in coal, pyrite in overburden, and carbonate minerals in overburden show that acid production is dependent on pyrite content of the overburden rather than pyrite in the coal. The work forms the basis of several large research and demonstration projects for testing and extending the ideas of carbonate control of acid.

2. Size Reduction and Liberation

Studies have resulted in a major technological process innovation that involves a combination of the calcination and sintering phenomena into a single step process. Technologically, this new process has major implications for the processing of many other ceramics, as well as for the processing of basic refractories. It provides a production adaptable process that is both cost and time effective.

Other Beneficial Impacts:

The Mineral Institute has stimulated the preparation of a comprehensive research proposal to the Standard Oil Company of Ohio (Sohio). This proposal was successful and a Sohio Center for Scientific Excellence in Mining Technology was established at Penn Station with a funding of $2 million over the five year period (1983-88). Improved health, safety and productivity in the longwall method of underground coal mining are the goals of this research.

The MRI funding resulted in bringing in a senior faculty in mineral processing and supporting a broad range of outstanding graduate students in the areas of mining, mineral processing, geomechanics, fuel science, petroleum engineering, metallurgy, ceramic science, mineral ecoomics and geosciences. During 1982, the MRI provided $20,250 in research initiation which attracted no less than $345,000 from industry in the area of mineral processing.

South Dakota - Institute Profile
(1978-82)

Director R. Norman Orava
School of Mines and Technology
500 East St. Joseph Street
Rapid City, South Dakota 57701

Activities (average number per year):

Research projects	10
Faculty support	8
Student support	
Undergraduate	2
Graduate	5

Total value of equipment purchased: $119,146

Industrial support for scholarships, fellowships and assistantships: $66,000 per year

Industrial Impacts:

1. Study of Temperature Profiles in Rock Using a Thermistor Probe

Equipment has been developed to measure the heat transfer properties of different rock types. A probe has been designed, constructed and tested to provide temperature readings inside diamond drill holes underground. Results are being used to improve underground ventilation systems.

2. Oxidation of Pyrite to Maghemite

A thin film of rust forms on the surface of pyrite under oxidizing conditions. This rust (magnemite) is only 70-100 microns thick but increases the magnetism of these small grains by an order of magnitude. This holds promise of allowing inexpensive removal of pyrite from coal, especially in slurry.

Other Beneficial Impacts:

The South Dakota MMRRI played an indispensable role in providing the resources to persuade Dr. James J. Papike, an outstanding geologist and alumnus, to return to the State and join our faculty. With his leadership, the Institute for the Study of Mineral Deposits was established in 1981. The Institute has about one-quarter million dollars of research support from NASA, NSF, and DOE. His presence also resulted in the loan by NASA Johnson Space Center of a $300,000 electron microprobe, a facility unique to the state. Dr. Papike's projects have also contributed to the acquisition of an atomic absorption/inductively-coupled plasma spectrometer. Both Instruments upgrade the School's capabilities with direct benefits to the solution of the nation's problems. Conducted or assisted in conducting various workshops, conferences and short courses: (1) "What Mining is All About," "Computer Applications for the MineralIndustry," "Western Regional Conference on Gold, Silver, Uranium and Coal," "Remote Sensing," "Oil and Gas Potential in South Dakota," (1981); (2) "Remote Sensing," "Coal Bearing Sequences," "Spontaneous Combustion of Coal," "Oil and Gas Potential in South Dakota," "Status at Coal Geology in Northern Great Plains" (1982). Supported new faculty member in mining (1982).

Texas - Institute Profile
(1978-82)

Director L. F. Brown, Jr.
Bureau of Economic Geology
University of Texas - Austin
University Station Box X
Austin, Texas 78712

Activities (average number per year):

Research projects	6
Faculty support	4
Student support	
Undergraduate	2
Graduate	9

Total value of equipment purchased: $56,484

Industrial support for scholarships, fellowships and assistantships: $10,238 per year

Industrial Impact:

1. Assessment of Lignite Exploitability in the Deep Basins of Texas

Research funded by the Mineral Institute led to development of generic concepts to fully exploit Gulf Coast lignite resources. Depositional systems analysis permits prediction of distribution, approximate reserves, quality, and environmental impact before mining. Further research developed techniques and models required to assess engineering and economic feasibility for in situ extraction. Hydrochemical models of fluid flow in lignite strata provide the basis for evaluating the environmental, engineering, and economic future of Gulf Coast deep-basin lignite resources. Research continues in all phases including petrographic and geochemical characterization of lignite to permit proper utilization of the resource.

2. Mineral Exploration Models in Trans-Pecos Texas

The Mineral Institute and Texas have supported development of frontier exploration concepts in Southwest Texas, a province with enormous potential but limited exploitation of hard minerals. Using modern structural and igneous geological approaches, considerable advancement of mineral potential has been accomplished. Exploration models developed from geological and geochemical data collected in this project will continue to encourage and assist exploration by the mining industry. This region may be a critical new minerals province in the 21st century.

Other Beneficial Impacts:

Mineral Institute funds stimulated appropriation of $158,000 in State funds to permit establishment of the first State Coal Laboratory and complete modernization of the University's Mineral Studies Laboratory. An international quality lab in the State is and will continue to stimulate further State funding and cooperation with Texas industry interested in the potential for mining, minerals extraction, and utilization. This capability, coupled with proven expertise in in situ extraction research for uranium and lignite, provides the basis for growing industrial and university cooperation for decades to come.

Utah - Institute Profile
(1978-82)

Director Ferron A. Olson
University of Utah
412 Browning Building
Salt Lake City, Utah 84112

Activities (average number per year):

Research projects	15
Faculty support	1
Student support	
Undergraduate	13
Graduate	20

Total value of equipment purchased: $365,000

Industrial support for scholarships, fellowships and assistantships: $42,000 per year

Industrial Impacts:

1) Design and construction of a Laser Monitoring System to detect ground settlement. The system was designed to monitor vertical settlement of mine waste embankments. Such monitoring is desirable to detect anomalous movement which might indicate potential instability. The system is now operational and has successfully detected movement with minimum interference to mining operations.

2) Development of an air sparged hydrocyclone which will allow separation of minerals in a much smaller space than has been heretofore possible in the usual flotation cells. This novel device has promise in mineral separation and has received considerable interest.

Other Beneficial Impacts:

The Utah MMRRI has significantly helped maintain a strong minerals program at Utah at a critical time when other funding was not available. Of the average number of 20 graduate students assisted each year since 1978 with support for research and stipends 16 have received M.S. degrees and probably more importantly 12 have received Ph.D degrees. Another 3 to 5 in each category will receive advanced degrees by July 1984. In addition to the direct support given to research one partial academic salary and some summer research support was given to new faculty. Funding has also been provided for an outstanding lawyer to teach a course each year in Mining Law.

Possibly the most significant recent impact has been the dramatic growth in comminution as a result of Utah obtaining federal funding, fall 1982, for the Generic Center in Mining Technology in Comminution. Specialized laboratories have been established in: Fragmentation, Automatic Control, Size Separation, Corrosion and Wear, Characterization and Computation. Visiting faculty, research professors, post doctoral students, technician and staff for a Reference Center in Comminution have been added to give the program a significant forward thrust towards establishing Utah as the outstanding academic center in comminution. Equipment has also been added to augment the previously established comminution facility. Industry has been supportive; $205,000 of the annual budget is from industry.

Virginia - Institute Profile
(1978-82)

Director Paul E. Torgerson
College of Engineering
Virginia Polytechnic & State University
Blacksburg, Virginia 24061

Activities (average number per year):

Research projects	7
Faculty support	6
Student support	
Undergraduate	6
Graduate	5

Total value of equipment purchased:	$187,000
Industrial support for scholarships, fellowships and assistantships:	$50,000 per year

Industrial Impacts:

1. Ground Control Mechanisms in Multi-Seam Mining

The objective is to develop quantitative techniques to determine the effects of stress in mining vertical multiple coal seams. A handbook will deal with multiple seams by advancing design procedures and solutions to problems which should reduce losses in the form of coal reserves no longer capable of being mined.

2. Image Processing for the Beneficiation of Complex Sulfide Ores

The objective is to use computer-analyzed television-derived images to determine the mineral relationships in ores and the rates of liberation in comminuted specimens. This will allow for more efficient processing and recovery of metal-bearing phases from complex sulfide ores.

Other Beneficial Impacts:

The Mineral Institute has stimulated the founding of Virginia Center for Coal and Energy Research by act of the legislature with the Governor's endorsement. This reflects the awareness in the state of the economic impact of the coal-producing industry, the coal-hauling railroads, the coal-burning electric utilities and the coal-exporting facilities at Hampton Roads, Virginia.

Money from the MMRRI program has influenced faculty to find ways to apply their expertise to problems of concern in the areas of minerals and mining.

Graduate assistantships have influenced students to choose their topics in minerals and mining, and influenced career choices. A former doctoral student whose research was on the analysis of synthetic fuels is currently in a postdoctoral position at Colorado State. His work is important for studies of catalysts.

Washington - Insitute Profile
(1978-82)

Director O. J. Whittemore
Dept. of Materials Science and Engineering
University of Washington
Seattle, Washington 98195

Activities (average number per year):

Research projects	8	
Faculty support	8	
Student support		
Undergraduate		10
Graduate		33

Total value of equipment purchased: $85,900

Mini-Research Projects:

The most successful activity of the Institute is the mini-research project. Seed money grants from $2,500 to $6,500 are made to faculty for the preparation of a research proposal to be submitted to another agency. Since the Institute began in 1980, 34 projects have been funded, from which proposals totalling over $2,000,000 have ensued. Grants over $400,000 have been identified as resulting from these proposals.

Successful projects have resulted in research on new processes for aluminum and iron reduction, on arsenic removal from copper ores, on development of olivine heat storage media, and on mine waste water detoxification. Current projects are on steel refining, arsenic in copper slags, refractory concrete, exploration geology, underground coal gasification, and mine wastewater treatment.

The projects are classified as: Extractive Metallurgy - 12; Exploration Geology - 9; Ceramics & Mineral Processing - 5; Environmental Aspects - 5; Mineral Economics - 1; Social Aspects of Mining - 1.

Appropriately the lead category is extractive metallurgy since in Washington the value of primary metals is many times that of mined minerals. Washington ranked first in primary aluminum production in 1982 and has the only copper smelter in the United States handling high arsenic ores and producing arsenic. The Washington manufacturing gross income of primary metals was $2,303,700,000 in 1982 and for stone, clay, and glass: $595,800,000. The value of Washington's nonfuel-mineral production was esimated in 1982 as $183,000,000, of which nonmetal minerals accounted for 96% including cement, clays, diatomite, gypsum, lime, olivine and talc. Metal minerals totalled 4% and included silver, copper, gold, lead, and tungsten.

West Virginia - Institute Profile
(1978-82)

Director M. Dayne Aldridge
Energy Research Center
West Virginia University
258 Stewart Street
Morgantown, West Virginia 26506

Activities (average number per year):

Research projects	14
Faculty support	5
Student support	
Undergraduate	5
Graduate	14

Total value of equipment purchased: $56,028

Industrial support for scholarships, fellowships and assistantships: $232,000 per year

Industrial Impacts:

1. Acid-Base Accounting

An "acid-base accounting system" has been developed and accepted as a standard by the West Virginia Department of Natural Resources, West Virginia coal operators and the U.S. Office of Surface Mining. Acid-base accounting determines the maximum amount of acid that a material is capable of producing and the corresponding amount of base necessary to totally neturalize the acid. The system, developed by Richard Smith and John C. Sencindiver, WVU division of plant and soil science, helps the surface mine operators to economically meet the requirements of current surface mining environmental laws. Technological Impacts: made surface mining at many West Virginia sights possible under Federal regulations.

2. Sediment Control Pond Baffles

Low-cost modifications to surface mine sediment control ponds have been tested and shown to be effective in decreasing the sediment load of effluent. The easily installed baffles were designed by Charles Jenkins, WVU professor of civil engineering. They increased sediment pond efficiency and decreased operating costs by allowing surface mine operators to construct smaller and longer-lasting ponds. The project was supported by funds from the WVU Mining and Minerals Resources Research Institute and by matching dollars from the state. Significant industrial involvement has helped in proving this development. Technological Impact: the cost of constructing and maintaining sediment control ponds is being significantly reduced.

Wyoming - Institute Profile
(1978-82)

Director David O. Cooney
P.O. Box 3295
University of Wyoming
University Station
Laramie, Wyoming 82071

Activities (average number per year):

Research projects	14
Faculty support	9
Student support	
Undergraduate	3
Graduate	13

Total value of equipment purchased:	$97,200
Industrial support for scholarships, fellowships and assistantships:	$25,000 per year

Industrial Impacts:

1. Influence of Powdered Activated Carbon Addition on Activated Sludge Oxygen Uptake Rates

Activated sludge treatment systems, widely used as a means of treating and disposing of organic wastes and proposed as a potential method for removing undesirable organic compounds from oil shale retort wastes are sometimes rendered ineffective because of poisoning from heavy metal ions or from organics, such as phenols. In this work, the effect of PAC was studied quantitatively in restoring biological activity of poisoned activated sludge.

2. Low Temperature Carbonization of Wyodak Coal

Low temperature carbonization of Powder River Basin coal can increase its heating value by as much as 40 to 60% through reduction of the moisture content. In addition, valuable gaseous and liquid products can be produced in the process. This project is designed to determine the important parameters in carbonizing prior to shipping by rail.

Other Beneficial Impacts:

Supported travel for faculty and students (1979); initiated Surface Mining Program (1980); hired two new faculty (chemical and petroleum engineering) (1981).

APPENDIX I

National Association
of State Universities
and Land-Grant Colleges

Robert L. Clodius, President

12/8/83

DIRECTORS
OF
STATE MINING AND MINERAL RESOURCES AND RESEARCH INSTITUTES

*Dr. R. Bruce Tippin
Drawer A Y
University of Alabama
University, AL 35486
205-348-6577/5452

*Dr. Nolan Aughenbaugh
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907-479-7366/7577

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Asst. Dean for Resch. Develop.
Colorado School of Mines
Golden, CO 80401
303-273-3000

*Dr. John E. Husted
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  Resources Institute
Georgia Institute of Technology
Atlanta, GA 30332
404-894-2893

*Dr. George A. Williams
College of Mines
University of Idaho
Moscow, ID 83843
208-885-7989

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321 Patterson Office Tower
University of Kentucky
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*Dr. Ralph W. Pike
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118 David Boyd Hall
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504-388-6891

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Min. & Minerals Res. Resch. Inst.
MIT, Room 4-140
77 Massachusetts Avenue
Cambridge, MA 02139
617-253-3305

Dr. Lloyd A. Heldt
Ctr. for Mining and Mineral
  Resources Research
Michigan Technological University
Houghton, MI 49931
906-487-2631

*Dr. Kenneth Reid
Director, Min. Res. Rsch. Ctr.
University of Minnesota
56 East River Road
Minneapolis, MN 55455
612-373-3341

*Dr. J. Robert Woolsey
University of Mississippi
Miss. Mineral Resources Institute
University, MS 38677
601-232-7320

*Dr. David J. Barr
School of Mines & Metallurgy
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ND Mining & Mineral Resources
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Box 8103, University Station
Grand Forks, ND 58202
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233 Koffolt Labs
140 W. 19th Ave.
Columbus. OH 43210
614-411-3837

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110 Mineral Sciences Building
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Dean, Grad. Div., & Dir. of Rsch.
SD School of Mines and Technology
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Rapid City. SD 57701
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*Dr. L. F. Brown
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*Dr. P. E. Torgersen
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Virginia Polytechnica Institute
  & State University
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*Mr. O. J. Whittemore
Dept. of Mining Metallurgical
  & Ceramic Engineering
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206-543-2012

*Dr. M. Dayne Aldridge
Energy Research Center
West Virginia University
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Morgantown, WV 26506
304-293-2867

*Dr. David O. Cooney
College of Enginerring, POB 3295
The University of Wyoming
University Station
Laramie, WY 82071
307-766-6314

NASULGC Members*	26
Other**	5
	31

Non-Members
South Dakota School of Mines and Technology
Montana College of Mineral Science & Tech.
Michigan Tech University
New Mexico Institute of Mining and Tech.
Colorado School of Mines

National Association
of State Universities
and Land-Grant Colleges

Robert L. Clodius, President

APPENDIX II

1984 Mineral Resources Committee

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Note: Dr. Barton was Chairman of the Committee in 1983 during the conception

1983 Mineral Resources Committee (cont'd)

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Rolla, MO 65401
(314) 341-4846

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TWX 710•822•0126
J. ALLEN OVERTON JR
PRESIDENT

Appendix III

AMC MINING AND MINERALS EDUCATION COMMITTEE

September 1983

Chairman: Jack E. Thompson, President, Newmont Mining Corporation, 200 Park Avenue, New York, New York 10166

J. R. Cool, Senior Vice President-Human Resources, Government and Public Affairs, Kennecott, P. O. Box 11248, Salt Lake City, Utah 84147

Alternate: Hugh W. Evans, President, Old Ben Coal Company, 69 W. Washington Street, Chicago, Illinois 60602

Donald A. Dahlstrom, Senior Vice President of Research and Development, Eimco Process Equipment Co., P. O. Box 300, Salt Lake City, Utah 84110

Roger M. Haynes, Vice President-Human Resources, Consolidation Coal Company, 1800 Washington Road, Pittsburgh, Pennsylvania 15241

Carl R. Heinz, President, Joy Machinery Company, 301 Grant Street, Pittsburgh, Pennsylvania 15219

Ralph L. Hennebach, Chairman, ASARCO Incorporated, 120 Broadway, New York, New York 10271

Alternate: Bobby J. Jackson, Director-Safety and Technical Employment, ASARCO Incorporated, Suite 414, 10 West 1st South, Salt Lake City, Utah 84101

Keith R. Hulley, Vice President-Mining & Development, Amselco Minerals Inc., 999 Eighteenth Street, Denver, Colorado 80202

Louis R. Kasdan, Director of Public Relations, AMAX Inc., AMAX Center, Greenwich, Connecticut 06836

Alternate: Gordon McArdle, Manager-Technical Information, AMAX Inc., AMAX Center, Greenwich, Connecticut 06836

Dean W. Lynch, Director of Public Relations, Duval Corporation, 4715 E. Fort Lowell Road, Tucson, Arizona 85712

Archie E. Moran, General Manager-Coal Operations, United States Steel Corporation, 600 Grant Street, Pittsburgh, Pennsylvania 15230

Mike Musulin II, Assistant to the Executive Vice President, Island Creek Coal Company, P. O. Box 11430, Lexington, Kentucky 40575

Richard F. Novak, Manager-Industrial Relations, The Cleveland-Cliffs Iron Company, 14th Floor Huntington Building, Cleveland, Ohio 44115

Carl L. Randolph, Vice Chairman and President, U.S. Borax & Chemical Corporation, 3075 Wilshire Boulevard, Los Angeles, California 90010

Donald O. Rausch, President, Western Nuclear, Inc., 134 Union Boulevard, Lakewood, Colorado 80228

Milton H. Ward, President, Freeport Minerals Company, 200 Park Avenue, New York, New York 10166

Thomas H. Wilson, Vice President-Human Resources & Industrial Relations, The Hanna Mining Company, 100 Erieview Plaza, 36th Floor, Cleveland, Ohio 44114

N. R. Zehr, Vice President, Ingersoll-Rand Company, 200 Chestnut Ridge Road, Woodcliff Lake, New Jersey 07675

Appendix IV

Names of companies providing direct and indirect support of institute activities:

Air Products Corp.
AISI
Alabama By-Products, Inc.
Alabama Methane Production Co.
Alabama Power Co.
Alaska Gold Co.
Alaska Mining
Alcoa
Alcoa Foundation
Allegheny Land and Mineral
Allied Chemical Co.
Alpine Resources
AMAX
AMAX Arizona, Inc.
Amax Foundation
Amax Zinc
American Association of Cost Engineers
American Cast Iron Co.
American Colloid Co.
American Smelting and Refining Co.
American Society of Metals
American Syncrude
Amoco
AMOCO Foundation
Amoco Oil Co.
Amoco Production Research
Anaconda Co.
Anaconda Copper Co.
Anaconda Grants, N.M. Uranium Leaching Plant and Tailings Disposal
Anaconda Minerals Co.
Anamax Mining Co.
Anshutz Mining Co.
Arco Coal Co.
Armco Foundation
Armco Steel Corp.
ASARCO
Ashland Oil Foundation
Ashland Synthetic Fuels, Inc.
Associated Electric Co.
Atlantic Richfield
Atlantic Richfield Foundation
B.F. Goodrich Co.
Bankhead Mining Co.
Barnes and Tucker Coal Co.
Battelle Columbus Division
Baukol-Noonan Inc.
Beaver Creek Coal Co.
Beaver Land Co.
Bechtel, Inc.
Beldon and Blake, Inc.
Bethlehem Steel Corp.
Black & Vetch Consulting Engineers
Black Diamond Coal Mining Co.
Black Hawk
Bluebird Operation
Breckinridge Minerals
British Petroleum Ltd.
C.E. Lummus
Caaterskill Exploration
Callahan Mining Corp.
Cannelton Industries
Carbogel
Carter Mining Co. (Exxon)
CELCO Mining Co.
CEM, Inc.
Central Ohio Coal Co.
Central Petroleum
Champlin
Chemetico
Chevron
Chevron Oil Field Research
Christopher Foundation
Cities Service Co.
Cities Service Co.-Miami Copper Operations
Cities Service Coal Co.
Cities Service Oil Co.
Cleveland Cliffs Iron Co.
Coal Conversion Systems, Inc.
Coastal States
Cobb Coal Co.
Coca Cola
Coggins Mine
Columbia Gas Research
Columbia Gas Transmission
Cominco (U.S.) Ltd.
CONOCO
Consolidated Coal Co.
Consolidated Gas Co.
Consolidation Coal Corp.
Continental Mines
Continental Pipeline co.
Cordero Mining Co. (Sun Oil)
Cotton Patch Mine
Cuber Co.
Cyprus Bagdad Copper Co.
Cyprus Johnson Copper Co.
Cyprus Pima Mining Co.

Davey McKee Corp.
Davison Mineral Properties
Decker Coal Co.
Diamond Shamrock
Dixie Steel Corp.
Dow Chemical Co.
Dowell/Dow Chemicals
Dravo
Drummond Coal Co.
Duval Corp.
E.I. du Pont de Nemours and Co., Inc.
Eagle Iron Works
Eastern Associated Foundation
Eastman Kodak
Electric Power Research Institute
Empire Coke Co.
Energy Development Corp.
Energy Enterprises
ENKAbv - Industrial Colloids - Holland
Ensign-Bickford
Envirotech Coal Services
Ernest Leitz Wetzlar GmbH
EXXON
Exxon Educational Foundation
Exxon Production Research
Exxon USA Foundation
Federal Bentonite
FMC Corp.
Ford Motor Co.
Freeman United Coal Co.
Gas Compression Roundtable
Gas Research Institute
Getty
Goldfields
Great Northern Iron Ore Properties
Gulf Chemical and Metallurgical
Gulf Oil Foundation
Gulf Oil, Inc.
Gulf Research and Development Corp.
Gulf States Paper Co.
Hach Chemical Co.
Halliburton Gas Transmission
Halliburton Services
Hanna Mining Co.
Hanson Oil Corp.
Harbison-Walker Refractories
Hastings Mining Corp.
Hemscheidt America
Hercules Aerospace
Homestake Mining Co.
Houston Natural Gas
Hudson Bay
Hughes Aircraft
Humphries Enterprises
Hunt Oil Co.
Hydrocarbon Research, Inc.
In-Situ, Inc.
Ingersoll-Rand, Inc.
Inspiration Consolidated Copper Co.
Institute of Gas Technology
International Coal Refining Co.
International Minerals & Chemical Corp.
Iowa Fuel and Minerals Co.
Island Creek Coal Co.
Jim Walter Resources, Inc. and Enhanced Energy Resources
John Deere
Jones & Laughlin Steel Co.
Joy Manufacturing Co.
Kennecott
Kennecott Copper
Kennecott Minerals Co.
Kerr-McGee Coal Corp.
King Knob Coal Co.
Knife River Coal Co.
Kopper's Co.
L. John Minnick
Livengood Joint Venture
London-Virginia Mine
Magma Copper Co.
Marathon Oil Co.
Massey Foundation
McAlester Fuel Co.
McConville Coal Co.
McDonnell Douglas
McIntyre Mines
Meriden Engineering
Mich Coal Co.
Miller Construction Co.
Minerals Corp.
Minneapolis Electric Steel Castings
Mississippi Corp.
Mitchell Energy
Mobil
Mobil Coal Co.
Mobil Petroleum
Mobil Research and Development Corp.
Mohawk Oil & Gas
Monsanto
Monterey Coal Co.
Mountain Creek Mine
N.L. Industries
National Mines Corp.
National Steel Corp.
Nebraska Ash
New York State Electric and Gas
Newmont

Nickel Plate Coal Co.
Nicor
Noranda Lakeshore Mines, Inc.
North American Coal Corp.
North River Energy Co.
North Star Steel Co.
Occidental Research Corp.
Oglebay Norton Co.
Ohio Ferro Alloy Co.
Pacific Foundation
Panhandle Fly Ash
Paraho Project
Parker Mine
Peabody Coal Co.
Penn-Virginia Resources Corp.
Pennzoil Producing Co.
Pete Lien and Sons
Phelps-Dodge Co.
Phillips
Phillips Coal
Phillips Petroleum Co.
Pickands-Mather Coal Co.
Pittsburgh and Midway Coal Co.
Pittston Coal Co.
Placid Oil
Plastic Techniques, Inc.
Popp & Hawley
Pozzolanic Eastern
Pozzolanic Northwest
PPA-Midwest
Precision Blasting Co.
Pyro Mining Co.
Quality Coal Co.
Quintana Minerals
R.C. Baker Foundation
Reichhold Chemical Co.
Republic Steel Corp.
Reserve Mining Co.
Roberts and Schaefer Co.
Rochester and Pittsburgh Coal Co.
Rockwell International
Sanara Coal Co.
Sakrete
Santa Fe Minerals
Saskatchewan Power
Science Support Program, ALCOA
Scott-Ortec Co.
Sharon Steel
Shell Companies Foundation
Shell Development Co.
Shell Oil Companies
Southeastern Fly Ash
Southern Company Services
Southern Ohio Coal Co.
Southern Pacific Petroleum
Southern Tube Corp.
Southland Royalty
Southwestern Illinois Coal Corp.
Southwestern Public Utilities
St. Joe Minerals
Stan Graves Drilling and Coal
  Tech, Inc.
Standard Oil
Standard Oil of Indiana
Star Coal Co. and Iowa Fuel and
  Minerals Co.
Stockham Valve
Stockton Gas Co.
Sun
Sun Production Co.
Tenneco
Tenneco Coal
Tennessee Chemical Co.
Texaco Research Co.
Texas Gulf Corp.
The Pittston Coal Group
The Texaco Co.
Thunder Basin Coal Co. (ARCO)
TLT Babcock
TOSCO
Tri-Con Mining, Inc.
Triton Coal Co.
TRW
Turris Coal Co.
TVA
U.S. Pipe and Foundry
U.S. Steel Corp.
Union Drilling
United Nuclear Corp.
Universal Oil Products Co.
Utah International
Valley Camp Coal Co.
Versatile Products, Inc.
Vicello-Grogan
Vulcan Materials Co.
W.M. Keck Foundation
Walker and Walker
Watson Foundation
WEDCO
Western Coal Co.
Western Energy
Westvaco
Whirlpool
WYODAK Resources
Wyoming Fuel Co.
Zeigler Coal Co.
Zeilars-Williams

Dr. HOLLAND. Our next speaker this morning is Dr. Swisher. He has a perfecting amendment he would like to suggest to you.

Senator WARNER. Thank you, Dr. Holland. The panel recognizes that their statements in their entirety will be put into the record.

Dr. Swisher.

STATEMENT OF DR. JAMES SWISHER, DIRECTOR, COAL RESEARCH CENTER, SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE

Dr. SWISHER. Thank you, Mr. Chairman and members of the subcommittee. I appreciate this opportunity to share my views on the bill with you.

Before discussing our proposed perfecting amendment, I would like to make a few general comments. Today many of the institutes either lead or are associated with one of five Bureau of Mines generic research centers. A large number of other institutes, including our own, are not and have been receiving over the past 2 years $150,000 per year in allotment grants.

Although this amount of money is not very great and much more could be put to good use I can say with conviction that it has carried a very important part of our program for two reasons. One is it provides scholarship and fellowship help to a number of students, who without that help would have been unable to carry out full-time course work in their programs in the minerals field.

Also, we receive money for seed research grants in areas which are not covered very well now by any other Federal program. For example, the budget in fiscal year 1984 in the Office of Surface Mining for research was only $1 million and not even that amount was actually spent on research projects.

Also, the outside contract research program by the Bureau of Mines has been reduced over the last few years to just a token level. Our allotment grant permits us to explore several innovative ideas and mining efficiency and the reclamation of mine lands.

We are now in a better competitive position to secure followup grants and contracts from private industry and other Federal agencies. For example, we received a $10,000 program in reclamation in 1979 through this program. In the following year, we were able to obtain a followup grant from surface mining for $130,000 for the same work.

Now to discuss our perfecting amendment. We feel that the bill in general provides a very good framework for the continuation of the mineral institute program. Section 10 on eligibility criteria, however, has been the subject of a lot of discussion over the past few months by my colleagues and me. It is apparent that the intent of section 10 is to insure that high standards are met in the program by the participating universities and we concur with that.

Our main concern is that none of the existing institutes could be eliminated by a technicality. Of special concern is the manner in which criterion No. 4 is stated and I quote:

> The presence of an engineering program in mining or minerals extraction that is accredited by the Accreditation Board for Engineering and Technology or evidence of equivalent institutional capability as determined by the committee.

Although this accreditation in mining engineering does insure that there is a quality undergraduate program, it says nothing about the graduate program. And also many of the existing institutes have their institutional strength based on departments of geology or metallurgy or mining or a combination of these.

For example, at my own institution, Southern Illinios University, in addition to the capabilities from our mining engineers, we also have important contributions from geology and even from the life sciences who are deeply involved in reclamation projects.

Together these units provide a strong institutional capability. For this reason, we would like to propose a perfecting or a clarifying amendment in the latter part of criterion No. 4 in section 10. The revised wording that we would like to propose is "evidence of substantial education programs in at least one of the disciplines in mining or mineral resources."

By acceptance of this amendment, we feel that the qualifications of the institutes for future work will be judged on the quality of their past work, how the proposed work fits the mission of the program as discussed in section 1(b) of the bill and how good their proposal is for future work.

That concludes my statement. I believe the next panelist to talk will be Dr. Reid.

Senator WARNER. Thank you.

Dr. Reid.

STATEMENT OF DR. KENNETH J. REID, DIRECTOR, MINERAL RESOURCES RESEARCH CENTER, UNIVERSITY OF MINNESOTA

Dr. REID. Thank you, sir. It is a pleasure for me to be here this morning. My position on this joint university panel is due to my position as chairman of the National Association of Mineral Institutes Directors and I would like to present evidence to you relating to the historic record of achievements and to the potential benefits of the continuation of the program.

There are currently 31 States that have mineral institutes. Twenty-two of those were established in 1978 and nine of them were established in 1979. Data have been collected from all of these institutes and been assembled into a report, which is a 5-year record of achievement and this volume is part of the evidence which is being submitted with the written testimony.[1]

Within that, there is a reference to quotations made in 1969, that is 15 years ago, in which there was concern about the lack of funding for mineral engineering programs in the universities and the associated decline in the development of mineral technology. These sentiments were echoed in 1980 in a report from the Subcommittee on Mines and Mining of the House Committee of Interior and Insular Affairs.

The crux of the matter was aptly summarized by Donald Tricline, the chairman of the Bethlehem Steel Corp., in a statement to the National Press Club on May 5, 1983, and I quote.

> To compete with the best, you must have the best, the best equipment, the most advanced technology, the most sophisticated techniques and methods and I think

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[1] The report appears following Dr. Holland's prepared statement.

most importantly the best trained people, not by U.S. standards, but by world standards.

There is a solid consensus within the university community and within industry that the generation of world class engineering graduates is of vital importance if we wish to compete internationally. The Mineral Institute program can be considered to have made a modest start in tackling these problems and in the first 5 years on a per year basis has supported a little over 200 research projects, over 300 undergraduate students, and over 400 graduate students.

This has resulted in an increase in the rate of production of higher degrees, a dramatic increase, but the actual figures, that is the numbers produced leave much to be desired. At the doctoral level, we have produced approximately 30 per year in seven disciplinary areas, and this is not enough to satisfy the needs of higher education, let alone the needs of industry and Government.

Within the document, there is a detail of the support from industry and there is a list of the industrial organizations and institutions supporting this program and that list contains over 300 entries. In relation to the research achievements from this program, although 5 years is a relatively short period of time in which to judge the progress and results, bearing in mind that this has to cover the procedures from the basic research through economic evaluation, technical development and demonstration, and, finally, to commercial success, despite this time constraint, we at this moment have some companies using technologies which were developed within the mineral institute program and others are involved in trial and evaluation programs.

Examples from each institute are contained within the detail of the report, which clearly supports the thesis that the national mineral institute program has made a significant national impact in accordance with the purpose of the original authorizing legislation.

In summary, it has stimulated research in a wide range of topics of regional and national importance and has already had industrial impact. Students have been attracted to the program and we have increased the rate of production of advanced degrees.

We have effected and implemented cooperative links with industry. The history of human civilization has shown that societies can exist under a widely divergent range of social, political and technological systems. However, it has also shown that all societies are based on the development and use of our Earth resources.

It is vital that we not lose sight of this fundamental fact and it is equally important for Congress to support the mineral institute program which is clearly focused on mineral resources. In relation to the benefits that can be expected to flow from this bill, it is easy to develop many arguments relating to strategic materials, to our critical reliance on imported raw materials, to the international competitiveness, to the needs of developing leaner domestic resources, health and safety issues, and the needed improvements in resource recovery and utilization.

These arguments are presented in our written testimony.

However, the key fact is that the bottom line rests on the resources we can assemble to tackle these problems and these resources are human resources, human resources trained through university programs to provide the skilled manpower called for by industry and to provide the innovative technology that we must have if we are to actively participate in the harsh reality of international competition today.

We have a modest program in place and we are beginning to produce results. We need this bill to be able to continue the job. Thank you, sir.

Senator **Warner**. Thank you very much. Dr. Holland. Our next speaker is Dr. Sendlein.

STATEMENT OF DR. LYLE V. A. SENDLEIN, DIRECTOR, INSTITUTE FOR MINING AND MINERALS RESEARCH, UNIVERSITY OF KENTUCKY

Dr. **Sendlein**. Thank you, Mr. Chairman and members of the committee. I too appreciate the opportunity to tell you a little bit about the University of Kentucky's program. I might add that I am here at the request of my Senator, Wendell Ford, who will share some of our experiences with you.

Senator **Warner**. I would like to inform the witnesses that Senator Ford and I both serve on the Rules Committee and we decided this morning that he would help with the conduct of the Rules Committee hearing that is taking place now and I would come and preside over this committee. So Mr. Ford and I are working in partnership and he wanted to be here this morning, but the business of the Senate required him to cochair the Rules Committee this morning.

If you will forgive his absence, he has provided me with a question, which I will propound when you have finished.

Dr. **Sendlein**. The University of Kentucky is a land-grant university and the institute for mining and mineral research, of which I am the director, is the unit in which the title III program has been assigned for management. Universities are complex organizations and they are composed of faculties with a wide base of knowledge and experience.

An organization like the institute for mining and mineral research is responsible for coordinating these activities, coordinating activities between the faculty from different departments, between faculties of different colleges, between faculties of different universities within the State and in other universities across the Nation, to coordinate activities with the university and government, both at the State level and at the Federal level, to try to coordinate our activities with industry, again, at the State level and on the national scale and, of course, with the public.

We serve in the areas of education, research and service just like the faculty members are required to serve. Let me give you a few examples in each of those areas of what our institute has done and what the University of Kentucky has done.

In education, we have an undergraduate scholarship program supporting approximately 65 to 70 mining engineering students each year in pursuit of their undergraduate degree. Through the title III or mineral institute program, we support approximately 17 graduate students each year through fellowship activities, and about seven of those; and about 10 through research grants that are awarded to faculty members and then these students work on those grants.

We are also coordinating an activity for junior colleges throughout the State of Kentucky who are training—they have 2-year programs—and they are training students to work actually in the mines as coal miners. So we are working at several levels in the educational areas.

In research since 1978, since the program has come on stream, we have supported about 45 research projects, which involved approximately 50 faculty members and about 60 students. In that area, we have performed research in exploration and as you know, Kentucky is the leading coal State. So much of our work revolves around coal.

But we have also in recent years emerged into the oil shale business and so we have done some significant work in oil share exploration as well. But the research has also focused on extraction, processing of the minerals, reclamation of the land after mining, utilization of these minerals and we have also expanded into the social, legal and economic areas.

I might just digress for a moment and say one of the new activities that we have created at the university is the mineral law center and this center is now focusing our law college to think about the problems that relate to the extraction and utilization of minerals in the State of Kentucky.

In the service area, obviously technology transfer is an important aspect of any university. We have a fairly organized activity at the University of Kentucky for technology transfer. This activity must, and the individuals that work in this activity, must find individuals, must find the research results, must find those individuals that have developed those research results, organize them into either courses, short courses or conferences or seminars, let this be known to all constituents that we have this knowledge that we want to transfer and then set up these conferences and short courses and deliver those activities.

We have had over more than 150 short courses and conferences that have resulted from this activity. And the mineral research program has been very instrumental in getting us off center to do this activity. So it has been a very important aspect.

Let me give you an example of how we go from an idea of research and then finally to technology transfer. We have, I think, a very good example of this at the university. As an initial grant, we supported researchers, faculty members in the colleges of engineering and agriculture to work on the control of sediment during the mining process.

These faculty members developed a program, a computer program to design sediment ponds. They developed this computer program to the point where it could be interacted with anyone who would like to use the program and so we then took that program and brought it forward and installed it in our computer and for a small fee anyone in the State of Kentucky can call up our computer after 6 o'clock and interact with that program to design their sediment ponds.

That program was so successful that our regulatory agency adopted it and said that they would recommend to the industry to use that program. Mind you, it has also become controversial, because in some cases the industry feels it might be a little too restrictive. However, the fact that it is controversial is not the real problem.

The real problem is that we have now brought forward some knowledge and a design method that can be used. To this date, we have had over 2,500 different users of this program, not only from Kentucky, but we have people coming from not only the surrounding States, but from other countries, such as Australia. We have had a company come to learn the program there.

In order to get this information out, we offer short courses three times a year on how to use this program. So that gives you just one example of how an idea was developed as a part of the program and then carried right through to the delivery of the technology.

What I have tried to illustrate with just that one example is that there were two colleges involved in it, but it turns out that in our program we have six colleges that are involved in the development of research and educational programs in mining and mineral resources. So the program has great breadth.

It is my opinion that it is that breadth that makes the program so successful and it is the support of an institute like ours that allows us to get to all of these faculty members who normally would not be available in just one discipline, but they are in many disciplines.

In fact, I would say that if we were just supporting a single discipline, such as our mining engineering program, which we also support, that many of these ideas that we have touched on would not have been addressed by the program.

So with just those few words, I would like to say that I think that a new force has sort of emerged on the scene to the congressional action of this bill and that I feel that continuation of this bill will definitely support the growing industry that is out there. We need new ideas and it is from a program like this that new ideas come and the perfecting amendment that Dr. Swisher has proposed, I believe, will insure that this breadth stays there.

And I think we need to have support like we have from you to continue the activity.

Thank you very much.

[The prepared statement of Dr. Sendlein follows:]

Statement to the
Subcommittee on Energy and Mineral Resources
of the
Senate Committee on Energy and Natural Resources

Relative to S. 2186, "a Bill to establish a
State Mining and Mineral Resources Research
Institute Program, and for other purposes"

February 10, 1984

by

Lyle V. A. Sendlein, Director
Institute for Mining and Minerals Research
University of Kentucky

Mr. Chairman, Members of the Subcommittee, my name is Lyle Sendlein and I am the Director of the Institute for Mining and Minerals Research at the University of Kentucky. I appreciate the opportunity to present to this committee information on the Mining and Mineral Resources Research Institute (MMRRI) program of the University of Kentucky, which is partially funded by Title III of Public Law 95-87. The Institute for Mining and Minerals Research, which is the unit that the Title III program is assigned to, was founded in 1972, five years before the MMRRI program was established. The importance of research on mineral resources was well recognized by university and state officials and in 1974 a major funding program was initiated by Governor Ford to increase our knowledge of coal and other mineral resources and to increase the quality and number of people working in the mineral industries of the Commonwealth. Forty million dollars have been invested by the state in the research effort and this has been matched by one million dollars from the Title III MMRRI program and about seven million dollars from industry and other sources. This program has been very successful and I have summarized the major accomplishments in the appendix of this statement.

I would like to speak to the importance of the MMRRI program to the national interest. The United States is no longer at the leading edge of technology in mineral extraction, nor or we producing those rare individuals that change the technology by their great intellect. Our mining and mineral resource education programs have been intimately tied to the ups and downs of an industry such that the stability of programs is rare and the level of available funding to move the technology forward has been much less than that of other industries. This is a paradox because without the ability to find and extract minerals from the earth, our society could not enjoy the level of amenities they presently do. The establishment of the MMRRI program in 1977 was long overdue, however the language of the bill was well constructed because it created a program that would break us out of the mold of decades of education and research traditions that had not pushed us into the forefront of technology in the mineral field.

The creation of thirty-one MMRRI's has brought to bear on the mineral resources problems of this nation a range of expertise that has not been coordinated anywhere before. The MMRRI's meet the needs of their own state's mineral resource base and at the same time contribute to the general knowledge, educate young people for the future work force, educate the future teachers to pass on the knowledge and through this effort address the special needs of the industry of their state. The accomplishments of the program are well documented in a summary paper presented to this committee. If you study the document you will see that the other states have a history similar to Kentucky relative to matching funds from state and industry and have produced educated people for the mineral industry. There is overwhelming data to support the reauthorization of the program and I hope you will support this bill to see that the fine work that has been started will be allowed to continue.

There has been discussion by members of this committee and others in the Congress that this program must be reduced in size, that is, some universities should be eliminated from the program so that there will be more funds available for the remaining schools which, it is believed, should be the traditional mining engineering schools. In principle this may appear to be a sound decision, however in practice it will not break us out of the traditional mold that has placed us in the position we are in now, which is non-competitive with the world market. We need new ideas! By having thirty-one universities involved we have the potential to tap new people with new ideas to old problems and to create new ways to find, extract, process and utilize the mineral resources of the nation. This program costs the Federal Government $9.25 million per year and in my estimation reaps a return of products, both human and technical in excess of $100 million per year.

The bill states that the subject areas to be addressed "... may include exploration, extraction, processing, development, production of mineral resources, mining and mineral technology, supply and demand for minerals, conservation and best use of available supplies of minerals, the economic, legal, social, engineering, recreational, biological, geographical, ecological, and other aspects of mining, mineral resources and mineral reclamation; having due regard to the interrelationship with the natural environment...". These are not subjects that are normally contained in a traditional mining engineering program and thus if the funds go only to these programs, these subject areas will not be addressed and the very problems that have limited the creativity and innovation in the mineral resource industries will not be addressed and thus not solved. The program is presently designed so that the traditional programs are being funded and they can continue their work and the non-traditional programs are also funded and new people and ideas are being focused on the problems of the field of mineral resources. It is my opinion that it is the non-traditional programs that are being considered for elimination.

For this reason I want to make sure you are aware of the wording in Section 10, paragraph (4) that could be used to eliminate those programs that do not fit the traditional mold. To require accreditation of the mining engineering program by the Accreditation Board for Engineering and Technology is only half of the subject area to be covered and therefore there must be another way to include those university programs that have made significant contributions to the Title III activity but are not covered by a specific accreditation body. Therefore the language proposed by Dr. Swisher and the National Association of State and Land Grant Universities as a perfecting amendment is wholly supported by us.

A new force has emerged on the scene of mineral resource research and education as a result of Congressional action, and it would be a great loss if the program is not renewed. I hope you will give this program serious consideration and should you need additional information, the Commonwealth of Kentucky stands ready to assist you in any manner. Thank you.

APPENDIX

(I. Value of the Mineral Institute to Kentucky)

The University of Kentucky is the land-grant institution for the Commonwealth of Kentucky and is centrally located in the City of Lexington. It is the Commonwealth's flagship university with its efforts and program activities directed toward performing the three primary functions of teaching, research and service. More than 35,000 students are enrolled in the main campus and 13 state-wide community colleges.

Taking cognizance of the fact that Kentucky is the largest coal-producing state in the nation, and in addition, has extensive reserves in coal, limestone, and oil shale, with other reserves in oil and gas, fluorspur, and some zinc, the University created a research institute (the Institute for Mining and Minerals Research) in October, 1971, to conduct research, education, training, and service programs of critical importance to the mining and minerals industries of the Commonwealth and the nation. These efforts have blossomed into an international program attracting signed research contracts with China and Spain.

Since the creation of the Institute, the University has conducted almost $40 million in energy utilization research for the Commonwealth alone, which includes operation by the Institute of the state-owned Kentucky Center for Energy Research Laboratory for the Kentucky Energy Cabinet.

However, one void at the national level and therefore at the state level is a program directed solely to the education and training of mining and mineral related scientists and engineers. This void, since 1978, has been partially filled by Title III of the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87). Since 1978, Title III funds have helped the University of Kentucky to support 50 research projects involving more than 50 regular faculty and almost 65 students.

Other benefits have accrued to our University as well from the Title III funds. Almost $100,000 in mining and minerals related research equipment has been added to the University. More than 150 short courses, seminars, conferences, and training programs have been supported. And, several students are employed by the Institute to help administer the Title III program; giving them invaluable management experience in the administration of public programs related to mining and mineral resources.

The University has created a Mineral Law Center to tackle the legal issues surrounding minerals. The University Medical Center has respiratory and environmental health programs. The Agriculture College has significant ongoing reclamation programs. It would be insane to think that the quality of mining and mineral resources research and development is reflected solely by whether its mining engineering program is accredited or not.

Mining and mineral resources research and development at the University of Kentucky is a multidisciplinary program of several ingredients. No single academic unit comprises a majority of the University's efforts. The focus of support at the University is on maintaining and improving this broad base, not focusing upon one academic program to the unreasonable exclusion of other academic units.

All of these contributions are necessary and critical additions to a state that had more than 3,000 commercial coal mines alone, not to mention the fact that it also leads the nation in coal production. Private industry has not and is not financially capable of supporting such a program, thus making it incumbent upon the United States to support such a critical source of mining and mineral scientists and engineers.

(II. Significant Achievements of the Institute)

Next, I would like to discuss some of the significant achievements of the Kentucky Institute.

1972: The Institute for Mining and Minerals Research (IMMR) was created by the University of Kentucky Board of Trustees, as an organized research unit of the University. Since the establishment of the IMMR in 1972, the Kentucky Energy Cabinet has contracted with IMMR to conduct more than $40 million in energy research for the Commonwealth of Kentucky. Approximately thirty (30) faculty members were affiliated with the IMMR program. The Kentucky Center for Energy Research Laboratory has 170 full-time staff members.

1976-1977: The IMMR contracted with the Kentucky Energy Cabinet to operate the Kentucky Center for Energy Research Laboratory, a $17 million facility conducting an energy utilization research and development program with more than 180 employees at approximately $7.5 million for FY 1984.

1977-1978: The IMMR was designated a Title III State Mining and Minerals Resources Research Institute under Public Law 95-87.

I want to further break down other achievements into the education, research and service categories.

Education

1. By 1982, approximately 70 mining engineering undergraduate and graduate students were financially supported partially or in full.

2. Since 1979, approximately 10 persons have participated in the IMMR Cooperative Graduate Degree Program in civil engineering, economics, and metallurgical engineering and materials science.

3. Mining and Reclamation Technology Programs have been supported by IMMR at 10 community, junior and four year colleges in Kentucky.

Research

1. Since 1978 the Title III funding has been used to support more than 45 research projects, 50 faculty members and 60 graduate students. Many of the projects have been instrumental in uniting industry and government and university researchers.

2. An atmospheric fluidized bed combustor has been installed and is providing data on Kentucky coal and limestone for the industrial boiler industry.

3. A resource assessment of the coal deposits within the Commonwealth has revealed additional reserves and provides critical information to the coal mining industry.

4. A Laboratory liquefaction research program has provided data for the emerging synthetic liquids industry.

5. Oil shale research has provided an accurate assessment of Eastern oil shale resources in Kentucky and has shown that Eastern shale has product yields approaching Western shales.

6. a. A joint research and training contract with the Spanish Government under the U.S.-Spanish Military Executive Agreement relative to atmospheric fluidized bed combustion is in progress.

   b. Signing of an agreement to conduct joint research and exchange coal related scientists with The People's Republic of China Central Coal Mining Research Institute has taken place.

Service

1. By December, 1982, the IMMR had conducted more than 150 short courses, seminars, workshops and symposia that have been attended by more than 5,000 people, through its outreach program, the Office for Informational Services and Technical Liaison.

2. The IMMR Library has approximately 50,000 mining and minerals related documents in its collection and provides support to the mining and mineral research resource community in Kentucky.

3. The assessment of research on acid rain has been compiled and the people and work being conducted within Kentucky identified.

Senator **Warner**. We thank you for your convictions in this area, Doctor, which are transmitted articulately and with great enthusiasm.

Dr. **Sendlein**. Thank you.

Senator **Warner**. The Chair wants to make certain that the record reflects accurately your linkage between the State of Kentucky and the coal industry. You said—how did you articulate that?

Dr. **Sendlein**. Between the coal industry and——

Senator **Warner**. And the State of Kentucky. I want to make sure that there are some "the's" in there, that Kentucky is one of "the" leading States. I think one got left out, Dr. Lucas.

Dr. **Sendlein**. At this stage, we are the leading coal State in terms of total production, but I think we are being overcome by our friends in the West.

Senator **Warner**. We have a little eastern competition there. We have got to represent West Virginia and Virginia there.

Senator Ford requests that you discuss this question. Does your institute in Kentucky need, and I emphasize the word need, the perfecting amendment discussed by Dr. Swisher?

Dr. **Sendlein**. The State of Kentucky at the present time, let me go back to the beginning. In the beginning when the institute was formed, when the institute program was formed there was stress on the fact that accreditation by the Engineering Board was required. That was left out of the initial legislation, but there was the need for mining engineers.

At the present time, since that time, our mining engineering program has expanded considerably. We have six faculty members. We were just recently visited by the Accreditation Board and we have not received the accreditation, but we feel it is forthcoming from the comments that were made by the reviewers.

The State of Kentucky, of course, would then be qualified under that part of the clause, but it is my opinion that the breadth is so important that if we force only toward one discipline we would lose the very strength, I think, that our institute now brings to the State of Kentucky.

Senator **Warner**. You may amplify on that question for the record after further reflection, if you so desire.

Dr. **Sendlein**. Thank you, sir.

Senator **Warner**. Now, we have my good friend and one of our most distinguished people from the State of Virginia, Dr. Lucas.

STATEMENT OF DR. J. RICHARD LUCAS, HEAD, DEPARTMENT OF MINING AND MINERALS RESOURCES, VIRGINA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Dr. **Lucas**. Thank you, Mr. Chairman. It is a pleasure for me to be here as a member of the Mineral Resources Committee and a representative of my university. I want to say it is a privilege of mine to represent Dr. Lavery here this morning, who sends his personal regrets. He would have been pleased to have offered testimony to this distinguished subcommittee. He personally wanted me to convey his warmest regards.

Senator WARNER. I appreciate that.

Dr. LUCAS. I represent a land-grant university.

Senator WARNER. We will put your entire statement in the record and if you would touch on the highlights, we would be appreciative.

Dr. LUCAS. I represent a land-grant university in the State of Virginia that has long been active in this field. It has a very large college of engineering and I am going to be concentrating on discussing one of the mineral institute programs. My colleagues have very effectively described the national implications of the program and various other aspects on it.

I would like to concentrate on the operation of one so that the committee might be able to see the effectiveness of this program. We have a large college of engineering with 6,000 students, 300 faculty members and the history is very important of mining and minerals engineering.

In 1885, it was the beginning of the first courses of mining engineering and these were initiated to address the beginning coal industry in the Virginia and the central Appalachian area. Our State responded to this and we have established the Virginia Engineering Experiment Station and subsequently the research division and in 1978, Gov. John Dalton designated VPI to be the site of the Mining and Mineral Resources Research Institute.

We have had a director who has supported us in our college of engineering and I want to say that our president, Dr. Lavery, has taken a personal interest in the development of this institute and its program.

Without this institute program focusing and spotlighting, I am not certain that this kind of attention would have been devoted to this very critical area and I think this is the most important. It should be recognized, Mr. Chairman, that everyone recognizes the role of the Federal Government in establishing national and international priorities.

Collectively this is done in this forum and in others. This leadership is translated and subsequently followed in the campuses throughout this Nation, in the legislatures throughout this Nation. Because of the Mining and Mineral Resource Institute program, the legislature in our State passed a Virginia Center for Coal and Energy Research, designated it to be at VPI, to establish the State format to further the goals of this program.

Further, each year the legislature in its budget passes a line item through the university budget to put their share of the 50-percent matching and they are following the leadership again of the Federal Government. I can assure you, Mr. Chairman, that without this leadership of the Congress and the Federal Government that the State legislatures would not be following and initiating these efforts, because this leadership is where it should be collectively on the national scene.

As you know, for over 100 years the railroads came to Appalachian and central Appalachian coal fields, the Norfolk & Southern and the CSX and its predecessors. This started a boom of this basic energy called coal that continues today and we saw in the seventies the importance of this commodity, not only for electric utility generation, but metallurgical coal, and the important export of this energy.

Another thing, and I am sure you are aware of it, Mr. Chairman, petroleum usage worldwide, 60 percent of it is invested in fixed energy consuming facilities; 40 percent of it is in mobile, transportation facilities. That 60 percent of international oils market will be some time in the future displaced by a much more economic commodity called coal.

International coal as an energy commodity has a greater future. Even today, the coal industry in our State as well as the mineral producing industry totals $2 billion a year f.o.b. the mines, if you were to add to it the coal mining industry's $2 billion, the coal mining service industry, the coal burning electric utility industry, the coal hauling railroad industry, and the coal exporting industry at the port of Hampton Roads, which is perhaps the largest coal exporting port in the world, as you know.

This is all based on low cost, high quality energy throughout the world. Now, a modest investment in our program of $110,000 initially started the program as an allotment grant, and $60,000 started the program with a fellowship grant. Then the thrust of the programs today is a fellowship program that supports in excess of 10 fellowship students and by in far a majority of them are Ph.D. students.

We have an annual allotment program that initially started at $110,000 a year and is now $150,000 a year, which is quite modest, but which leverages and—these are seed dollars that bring to the forum other investments. We have in this annual allotment grant 8 research proposals and 13 faculty members have been supported in their research.

We have then a research grant area of this program and we currently have six projects funded under the Generic Mineral Technology Center and four funded under, the projects have been supported directly by the Office of Mineral Institutes in the Department of the Interior.

We have an accountability system. The proposals that were submitted are reviewed, peer reviewed, and only the best are supported and also the accountability system has safeguards and fiscal safeguards, which guards the State of Virginia resources and also the same that protects and monitors the Federal resources.

I think maybe the greatest role that this institute has had, one of the greatest ones is a standing and pursuing and developing of critical mineral issues, mineral issues in the State of Virginia. This has a great impact not only on the State region but nationally and perhaps internationally.

I want to cite those and keep in mind we are discussing a mineral producing industry of $2 billion f.o.b. the mine. One, the issues of coal mining safety and health. Our Governor convened the commission because he thought this was one of the priorities that the State should address.

Two, surface coal mining control and reclamation. Mr. Chairman, you are involved in that and you know the basic deep-seated problems of technology that must be addressed and much of that has to be solved, I think, in the technology area.

Three, transportation of coal. It has so many ramifications that volumes could be published on this, not only the seed, railroads, and then another, technology that has been discussed recently on our scene in the State.

Four, problems of uranium mining in the Commonwealth. As you know, in the Commonwealth of Virginia the largest uranium deposit east of the Mississippi has been identified and even at this period, there is a great desire to develop that fantastic treasure.

Five, conservation and the environment and controlling the environment, and this is something that the mineral industries are sensitive to and it has a host of problems.

Six, is mineral processing and coal preparation, to take nature's coal and upgrade it so it will meet environmental considerations and also be competitive in the world.

The great impact, I think, of the institute program is the training of graduate students, MS and Ph.D. degrees. And I want to take a little aside from even what my Statement says and make a point. The engineering profession does not have adequate American Ph. D.'s to fill its needs. This is well known. The mineral engineering profession, even the field that I am in, is worse off than the engineering profession as well, as it has been defined.

Almost without exception a Ph.D. is the basic requirement for a faculty member at a university, tenure track faculty member. This requires substantial sacrifice on his part to invest a future career in teaching and research at a university compared to a more lucrative return of his efforts in industry.

Most Americans, if we let a laissez faire system prevail, will elect to take the industrial route. And we have the universities which will be training the seeds of the future, leaders in the future are left with modest resources and trained individuals. I personally, as well as others, recruit not in this country, which we find that resource to be at a very low minimum, which recruit around the world.

Interestingly enough, the nations around the world that recruit most fruitfully are the ones that have programs such as this, have programs where their talented people can be trained with support for research and also fellowship support.

Mr. Chairman, it may surprise some of you on the panel to know that we have the leadership of our educational institutions in some of these critical areas are not native-born Americans. The leadership in a few years will be in the hands of people who culturally and educationally are very competent people but, yet, are not sensitive to the historical, the traditional, and the competitive spirit that we have in our American industry. And this is one of the great contributions that I think is offered and I want to make another point. We have the great boom of the seventies, the training of Ph. D. students and undergraduate students have substantial good times. These cannot be turned on and off. I think this is the most critical to focus in on this most important resource, the training of graduate students, Ph. D.'s that are basically required and master students, who go out into industry and are very readily hired.

I hope this contribution has been helpful and I hope that you may respond by asking any questions. But I want to say that the leadership of the Federal Government in establishing priorities is paramount and many people follow that guide.

Thank you, Mr. Chairman.

[The prepared Statement of Dr. Lucas follows:]

STATEMENT
TO THE
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

on

S.2186, Reauthorization of the Mining and Minerals Resources Research Institute Program

Washington, D. C.
February 10, 1984

J. Richard Lucas, Head
Department of Mining and Minerals Resources
Virginia Polytechnic Institute and State University

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES, SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES:

I am J. Richard Lucas, Head, Department of Mining and Minerals Engineering, Virginia Polytechnic Institute and State University. It is my pleasure to strongly endorse S. 2186 with my colleagues on this panel representing the National Association of State Universities and Land-Grant Colleges, which represents some 100 universities and colleges, and its Committee on Mineral Resources consisting of representatives of the major mining and mineral engineering and science schools and departments of the nation. My university is one with a long history of instruction and research in this field. Further, it is my privilege to represent Dr. William E. Lavery, President, Virginia Polytechnic Institute and State University (VPI & SU), who sends his personal regrets to the Chairman for being unable to attend this hearing and to give testimony personally to this distinguished Subcommittee because of a conflicting commitment.

I and my colleagues are grateful to you and the members of the Subcommittee for extending an opportunity to offer this statement in support of S. 2186, Reauthorization of the Mining and Minerals Resources Research Institute (MMRRI) Program for a five-year period, FY 1985 through FY 1989. Because of the demonstrated interest in this program by my university, it is a pleasure to appear before you today as a representative concerning this proposed legislation and to offer a contribution to developing a record on this significant legislative matter.

Since the initial funding of the Mineral Institutes Program, fiscal year 1977, under Title III, Public Law 95-87, 31 institutes have experienced four to five years of participation in the program. The record shows that this program has clearly pursued the objectives of the legislation by significantly stimulating research and training of engineers and scientists on the undergraduate and graduate level in mining and mineral resources and technology by constructive establishment of qualified state mining and mineral resources research institutes.

As a result of a recent national survey, National Association of Mineral Institute Directors, it was concluded that the Mineral Institute Program stimulated a 500% to 600% increase in the number of master of science degrees produced and a 300% to 400% increase in doctoral degrees completed in these fields. Also this program has resulted in the support of 319 undergraduate students per year, 423 graduate students per year with an additional 123 students from separately-funded research projects, and 191 faculty members per year. This impressive record reflects the substantial contributions of this program to this important area of technology, which impacts substantially on the national scene.

VIRGINIA MINING AND MINERAL RESOURCES RESEARCH INSTITUTE---A CASE STUDY

While my colleagues have effectively described the national Mining Institute Program, perhaps it may be meaningful and appropriate for me to focus upon the results of the institute program at my university and convey its effectiveness in contributing to the state, regional and national interest during the last several years. An historical perspective may be in order to establish the foundation for the initiation of the Mining Institute Program in Virginia.

VPI & SU, a land-grant university, has an enrollment of 22,000 students, and the College of Engineering, containing the activity of the Mining Institute, consists of 10 academic departments and seven interdisciplinary technical interest groups which offer the B.S., M.S. and Ph.D. degrees. Currently, approximately 6,000 students are enrolled in the College of Engineering pursuing both undergraduate and graduate degrees. Each of the programs leading to the B.S. degree have been accredited by the Accreditation Board for Engineering and Technology (ABET). The College of Engineering represents more than 1/4 of the student body of the university with approximately 300 full-time faculty members, and an honors program is available and offers an opportunity for many gifted students to realize their full academic potential.

Courses in mining and minerals engineering have been offered since 1883 and the first degree in Mining Engineering was awarded in 1885. Mining engineering was established as a department in 1907 at the urging of the mining industry of Virginia and the Appalachian Region, which recognized the responsibility of the state for developing its mineral resources. Currently the Department of Mining and Minerals Engineering offers the B.S., M.S., and Ph.D. degrees for talented students in this important field.

For many decades the Virginia Engineering Experiment Station provided leadership and sponsorship for research in the College of Engineering, VPI & SU. In the 1960's, it was integrated into the Research Division, which pursued a similar function for research throughout the university. In 1978, Governor John Dalton certified VPI & SU as the university in the state eligible for a mining and minerals resources research institute and indicated that the university was "the land-grant university of the state with a substantial and extended program of instruction and research effort in mining and minerals extraction." As a result of a proposal submitted by the University in 1978, it was subsequently named by the U.S. Department of Interior as a Mining and Mineral Resources Research Institute. From its inception, Dr. Paul E. Torgersen, Dean, College of Engineering, has been the able director and has been fully supported by the administration of the University including Dr. William E. Lavery, President, who has taken a personal interest in the development of this institute and its program.

The need for the activities centered in the Virginia Mining and Mineral Resources Research Institute has been apparent in Virginia for over 100 years. The University has provided over a century of tradition in mining and minerals instruction, research and service to the Commonwealth of Virginia, the Central

Appalachian area, the southeast and the nation. The focus of mining and minerals research in Virginia and at VPI & SU has long been established and has resulted in a vigorous program with well-defined functions and objectives.

The significant historical development, which initiated the development of the substantial mineral industry in the Commonwealth of Virginia, was the arrival in the late 1800's of the railroads---the current Norfolk and Southern Railway and its predecessors to the Pocahontas coalfields of Virginia, West Virginia and Central Appalachia followed shortly by subsequent development and the appearance of the present CSX Railway and its predecessors. With the arrival of the railroads connecting the Central Appalachian coalfields with the historic port of Hampton Roads, Norfolk, Virginia, coal, the energy commodity, which would be used in the future for many purposes---energy for the electric utilities, metallurgical coal for the steel industry and export coal to be exported throughout the world---initiated a mineral industry boom that continues to the present day and advanced the development of the Appalachian coalfields, which have contributed much to the welfare of the nation. Coal production is the basic foundation of the mineral industry in Virginia, which currently produces products valued just under 2.0 billion dollars per year, F.O.B. mines values. Impacting upon the state, region and nation, development of the mineral resources of the Commonwealth has stimulated substantial economic activity in the following industries---the coal-mining industry, the coal-mining service industry, the coal-burning electric-utility industry, the coal-hauling railroad industry and the coal-exporting industry at the port of Hampton Roads, perhaps the largest coal exporting port in the world.

The coal industry has been in the vanguard for the development of substantial industrial efforts based upon a foundation of low-cost, high-quality energy to serve the nation and the world. Therefore at the end of the decade of the historic 1970's, which saw a boom of energy commodities throughout the world, it was most appropriate for this university to be awarded a grant for a Mining and Mineral Resources Research Institute (MMRRI), which consisted of $110,000 as an allotment grant and $60,000 as a fellowship grant by the Department of Interior. The allotment grant was promptly matched by $110,000 from the Virginia Legislature through a line item in the University budget to begin a well-received and a well-implemented program known as the Virginia Mining and Minerals Resources Research Institute, administered by the Land-Grant University of the Commonwealth of Virginia.

Accountability

The Virginia MMRRI, pursues its program in three separate categories, which are as follows:

Fellowship Program - Supports graduate students in mineral sciences and engineering with approximately 10 fellowships per year usually supported under this program.

Annual Allotment Program - Consists of a budget based upon $110,000 to $150,000 per year provided by 50% federal funding and an equal 50% funding matched by state funding, which is used to provide "seed" money for new research efforts. The "Annual Report" 1983, listed eight research projects involving the efforts of 13 faculty members.

Research Grants - Supports research efforts in several areas---mining evaluation and development, mining systems design, ground control, mineral processing, mineral economics, conservation and environmental control, among others. Four research projects have been funded directly by the Office of Mineral Institutes, and six research projects have been funded under the Generic Mineral Technology Center, Mine Systems Design and Ground Control. These were research projects obtained by the submission of competitive research proposals, which were selected by peer review.

An accountability system has been carefully designed to achieve the highest standards possible in pursuing research under this creative program. The following brief description may prove to be of interest. Each year faculty members, who desire to pursue appropriate mining and minerals research in departments of the university, submit the proposals to participate in the fellowship program and also submit proposals to participate in the allotment program, which provides "seed" funding for promising research projects. These proposals are submitted to the Director, Virginia MMRRI, and are reviewed by the Executive Committee, MMRRI, which report a collective recommendation concerning those priority proposals that deserve funding. Proposals are funded for one fiscal year beginning July 1 and ending the following June 30, which marks the beginning and the end of the fiscal year for the Commonwealth of Virginia. During the year, quarterly reports for each of the supported projects are forwarded to the Director, MMRRI, and a copy is subsequently forwarded to the Office of Mineral Institutes, Bureau of Mines. At the end of the fiscal year, a final report is submitted, and the same distribution is undertaken as in the quarterly reports. Further, publication of the results of the research effort is encouraged, stressed, and is a criterion for determining the subsequent funding of promising proposals. The accounting and fiscal safeguards that have been established for monitoring the expenditure of university and state funds are also the same safeguards that are implemented in the expenditure of funds associated with the MMRRI. It is felt that sustained accountability is present in the day-to-day operation of the Virginia MMRRI and in the priorities assigned to the research efforts and objectives to achieve and maintain high standards.

Virginia Center for Coal and Energy Research

Because of the significant resources of coal that are available in the United States, this commodity is destined to plan an important role in providing energy for this nation and other countries throughout the world. It is one of the leading sources of energy in the Commonwealth of Virginia, and its reserve base should support a producing coal industry for several centuries. As a result of this treasure of valuable coal reserves, the Virginia Legislature authorized the establishment of the Virginia Center for Coal and Energy Research (VCCER) in 1977 to reflect the increased awareness of the Commonwealth for the need for education, research, and development in the coal and energy industries.

The Virginia Legislature placed its trust in the Land-Grant University, VPI & SU, by housing the Center on the campus and the president of the university appointed as Director of the Center, Dr. Walter R. Hibbard, Jr., a University Distinguished Professor in the College of Engineering and a former director, U.S. Bureau of Mines. Into this setting and organization, it was natural that the Virginia MMRRI was organized to be an affiliate of the VCCER, which has responsibility for conducting research in coal production and utilization, developing educational programs in energy production and conservation, and providing programs for continuing education for in-service training. Therefore, the Virginia MMRRI was certain to prosper in this environment and to benefit from the experience and direction of seasoned individuals and administrators, who recognized that this effort was a priority of the University and the State of Virginia.

Critical Mineral Issues in the State of Virginia

Today in Virginia it is most appropriate to identify critical mineral issues that have an impact and are being deliberated throughout the Commonwealth. In this environment, the mineral issues, which are being pursued with much vigor that have an impact on the state, the region and the nation, are being clearly demonstrated. The program of the MMRRI is designed to develop a constructive contribution to the advancement and progress of these issues to improve the economy within the Commonwealth. Certainly in some of the issues, research and training may play an important ingredient in advancing the issues whereas in others the decisions that need to be made will be political decisions by elective officials in deliberative bodies, which receive technical, professional and research advice and consultation. A partial listing of some of these issues may be helpful in determining the potential impact of the Virginia MMRRI upon the activities of the $2.0 billion dollar per year mineral-producing industry: 1) Coal Mining Health and Safety, 2) Surface Coal Mining, Control and Reclamation, 3) Transportation of Coal, 4) Problems of the Uranium Mining Industry in the Commonwealth, 5) Conservation and Environmental Control, and 6) Mineral Processing and Coal Preparation.

In an effort to assist partially in these concerns, graduate programs in the University are sponsored by resources of the MMRRI and support education and training for graduate students to pursue the M.S. and Ph.D. degrees. Recognizing that the program has been in existance only in the last five years, its impact on research and development in the mining and mineral industry has much promise and may be substantial in the future. Also, the advancement of mineral technology and resource development will advance the strategic minerals program in this nation in strengthening the national defense of our country.

Traditionally, the mining industry has not supported significantly the mining educational institutions in graduate training for students, but the mineral industry employs these graduates for the knowledge and training obtained in the universities. It should be recognized that industrial laboratories are usually oriented towards production whereas university laboratories are oriented towards education and training of graduate students. One of the great advantages of the MMRRI program is that the resulting group of trained individuals will be available and responsive to civilian and government needs in the national defense of our country.

On behalf of the Committee on Mineral Resources, NASULGC, and of Virginia Polytechnic Institute and State University, I respectively urge the support of S. 2186, the Reauthorization of the Mining and Mineral Resources Research Institute Program, 1985-89, to continue this promising, relatively-new, and rapidly-developing program supported by modest federal and state outlays.

Senator **Warner**. Thank you, Dr. Lucas, Dr. Holland, Dr. Reid, Dr. Sendlein, and Dr. Swisher. We appreciate your valuable contribution and this testimony will be the foundation for getting this legislation through the Congress.

Panel 3, we have just one witness Jack Thompson, with Newmont Mining Corp. representing the American Mining Congress. Robin Turner, with North American Coal was to represent the National Coal Association today but by reason of personal problems was prevented from attending. However, his contribution to the record will be inserted at this point.

[The prepared statement of Mr. Turner follows:]

NATIONAL COAL ASSOCIATION

STATEMENT OF

ROBIN T. TURNER
VICE PRESIDENT - ADMINISTRATION
NORTH AMERICAN COAL CORPORATION
CLEVELAND, OHIO

BEFORE THE

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
OF THE
SENATE ENERGY COMMITTEE

ON

S. 2186 - A BILL TO ESTABLISH A STATE
MINING AND MINERAL RESOURCES INSTITUTE PROGRAM

WASHINGTON, D. C.

FEBRUARY 10, 1984

Mr. Chairman and members of the Subcommittee, my name is Robin Turner and I am Vice-President, Administration of the North American Coal Corporation, Cleveland, Ohio. I appear here today on behalf of the National Coal Association, which represents the bituminous coal operators in this country, to present their views on S. 2186, a bill to extend the Mining and Mineral Research Institute program.

There has been a gradual decline over the past 10 or 15 years in the number of mining and mineral engineers being graduated from colleges and universities in this country. As a result, there is a shortage of well qualified engineers and trained technical people in the mining industry. It also appears that scientists with backgrounds in coal and minerals often elect to specialize in other fields because of the many study and research options available in those areas.

To remain viable and competitive, the coal industry must have a sufficient number of well trained, creative and innovative engineers, scientists and technicians. In turn, the colleges and universities, where these technical people acquire their expertise, must offer programs and research opportunities that will attract students and professors. Our young people should be encouraged to select science and engineering in mining and

and minerals as careers.

The state Mining and Mineral Resources Institutes are now authorized under Title III of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The program provides Federal matching funds for qualified institutes at one public college or university in each state if it meets the eligibility criteria established by SMCRA. It is the duty of each institute to conduct competent research of either a basic or practical nature and to provide for the training of mineral engineers and scientists through such research.

There are 31 Institutes presently involved in the program and they constitute a major segment of the colleges and universities that are the principal source of engineers and other technical personnel required by the mining industry. As Mr. Thompson points out in his statement, through the establishment of these institutes, an infrastructure has been developed that helps address the training and research needs of the mining and minerals industries. This infrastructure should not be abandoned because it can be utilized as the framework for an even more effective program in the future.

S. 2186 was introduced to authorize a five year extension of the current mining and minerals institutes and to strengthen the existing program. The National Coal Association and its member companies support these objectives and believe that the proposed changes contained in the bill will be beneficial.

S. 2186 would call for greater participation by industry and the states in the maintenance of the institutes. The Federal authorization level of the program would be lowered from $22 million in fiscal 1984 to $7.5 million in fiscal 1985, whereas the non-Federal matching funds would be doubled by fiscal 1987 to $2 of non-Federal funds for every federal dollar. Existing law authorizes a $2 million increase in federal funds each year through 1984 and S. 2186 would reduce that to a $1 million increase each year through 1990.

We do not believe that the reduction in the funding levels will have any significant adverse impact on the program because of the improved coordination and planning provided by S. 2186 The bill requires that agency responsibility for Federal mining and mineral resources research and inter-agency coordination be clarified by the President. It also sets up a committee to advise the Department of Interior on its administration of the programs and to develop a national plan for research and development in mining and mineral resources. The committee must take into consideration any ongoing research efforts to make certain that duplication is avoided and recommend a program for implementing the plan. The plan must be submitted to the President, the Secretary and the Congress on or before March 1, 1986 and must be updated annually.

The bill also establishes a number of new criteria under which Federal grants would be made to the institutes, essentially to insure that the college or university does nave an institutional commitment to the purpose of the legislation. The school must have an accredited engineering curriculum. or its equivalent; the presence of a substantial program of graduate instruction and research in mining and minerals extraction and a demonstrated history of achievement. The committee will determine whether the criteria is met. The existing structure of the advisory committee would be modified to include representatives from industry and the academic community, as well as the Federal Government, in order to encourage cooperation and improve the quality and relevance of decisions on the research agenda.

The bill attempts to modify the structure of the existing program to avoid duplication, improve the quality and relevance of the research and keep in perspective the role that research is to fill in the training of students. For example, Section 2(b) requires each application for research funds to set forth the importance of the project to the Nation, region, or state cerned; its relation to other known research projects and the extent that the proposed project will provide opportunity for the training of mining and mineral engineers and scientists. Also Section 2(b) provides that funds shall be made available upon the basis of merit; the need for the knowledge which the research project is expected to produce when completed and the opportunity it provides for training. We believe these objectives are essential to ensuring that the program can function realistically and achieve beneficial results.

S. 2186 can make a significant contribution to improve the quality of the training and research in mining and minerals extraction. It is a reasonable approach and it will fulfill a recognized need to keep the United States on the leading edge of the international mining industry.

Senator WARNER. Thank you very much, Mr. Thompson, for your patience.

STATEMENT OF JACK E. THOMPSON, PRESIDENT, NEWMONT MINING CORP., ON BEHALF OF THE AMERICAN MINING CONGRESS

Mr. THOMPSON. Mr. Senator, I feel rather lonely sitting here by myself, but I know that Robin's words would have been along the same lines as my own. Since our statements will be inserted in the record, I would like to bypass reading anything and simply address two or three of the things I have been listening to this morning from the point of view really of industry rather than either the bureaucracy or acedemia.

Senator WARNER. That would be very helpful.

Mr. THOMPSON. If the United States is to stay competitive in minerals, it is going to have to be in the forefront on the technological side. We pay the highest wages in the world. We have the highest standard of living. We have more laws on pollution in the environment and safety than any other country in the world.

So the only way that we are going to stay competitive is if we stay ahead of the rest of the world in how we do it.

Senator WARNER. If I might interject at this point. Work on this committee and work on the Armed Services Committee has enabled me and other Members of the Senate to become well acquainted with the ever-increasing dependency of this country on imports, particularly those that are essential in our national defense.

And I somehow feel that the purpose of this bill and the contributions of witnesses and others this morning is directed toward that goal. We talk so often about training Americans, reliance on OPEC oil, and, indeed, we have got to focus on freeing our reliance on imports and I think part of that equation is educating and developing scientists and metallurgists to handle that problem.

Mr. **Thompson**. You have taken the words out of my mouth, Senator. Literally though from World War II until about 10 years ago, we were falling behind at a very rapid pace. There were very few graduates of any kind from our mining metallurgical schools. We have what we really should call a generation gap in the industry.

We have made up for that in the last 10 years to a great extent. But I do not agree with Mr. Furman's statement that we have a surplus or a potential surplus of engineers. We need them. The industry needs them and the coal industry in particular needs a good many engineers that it does not now have.

This program is without any question a very straightline method of acquiring not just engineers for industry, but the Ph.D.'s and the idea men who put this into, if you would, into action the ideas that come out of the work. So from the technological side of it alone, I think this is a very important bill and I would urge that it be thought of in that sense.

The mining is very cyclical in this country. It is a profit and loss situation. We are in losses at the present, but that is cyclical and I trust we will come out of it. But we are not able to do the funding of all of the research that needs to be done. We are just not that healthy of an industry. Unless we get some help, as we have been getting for the last 5 years, mainly from the Federal Government, a lot of research that needs to be done will not be done or it will be done in a slipshod manner.

This program has proven over the last 5 years that it can do a good job. It deserves, I think, a very strong effort on the part of the Government to keep it alive.

I would make a side comment with due respect to Dr. Swisher, I do not particularly agree with his amendment and I know that Robin Turner would not, simply because we are really trying to focus, I think, here on mineral and metal research. The circle of influence that you begin to have in the legal side or in geology and others is very good. It is good for the State and for the country and for the industry.

But the effort here is in research and the effort is in the technological research or mining method research and that is where I believe it should be. The 31 institutes that have taken advantage of this program are all because of their record since they have been eminently qualified to be there.

But there is a section of the act that says that they have got stay that way if they want to stay in the program and I would urge that it stay as it is and not be changed.

The other comment I would like to make directly is on the makeup of this so-called committee, which I know that Bob Horton would like to keep the control in his hip pocket in the Bureau of Mines and that is understandable, but I think that we need both the pragmatic approach of industry and the theoretical approach of academia, as well as the, if you would, the financial overview of the bureaucracy to make it work and work to the ends that it needs to work.

Speaking for the American Mining Congress and for my own company and I think for every mining company, we welcome the program and support it very strongly.

[The prepared statement of Mr. Thompson follows:]

Statement of

Jack E. Thompson, President
Newmont Mining Corporation

Mr. Chairman and Members of the Subcommittee, I am Jack E. Thompson, president of Newmont Mining Corporation and chairman of the American Mining Congress Committee on Mining and Minerals Education. I appear here today on behalf of the American Mining Congress to support S. 2186.

The American Mining Congress is an industry trade assocciation that encompasses (1) producers of most of America's metals, coal, industrial and agricultural minerals; (2) manufacturers of mining and mineral processing machinery, equipment and supplies; and (3) engineering and consulting firms and financial institutions that serve the mining and minerals industry.

The Mining and Mineral Resources Research Institutes program is of genuine benefit to the industry and to the nation. Through establishment of the Mining and Mineral Resources Research Institutes an infrastructure has been developed that helps address the training and research needs for the nation's mineral industry.

There is a recognized shortage of engineering manpower in our country, and the future growth and productivity of the mining and minerals industry may well be dependent upon the ability of universities to attract students and professors.

The 31 Institutes presently involved in the program are an integral part of the universities and colleges that provided the principal source of trained technical manpower needed by the industry. Through the research programs they carry out, the Institutes provide a focus of attention that attracts highly competent professors, who in turn mold the future managers and technicians by transfer of experience and training. The training of the new generation of engineers is not only essential to industry, but plays an increasingly important role in staffing governmental agencies where policy is developed.

The basic research carried out at the Institutes, ranging from projects aimed at removing sulfur from coal to development of new mining equipment and techniques, is of great value in solving many of our problems relating to the environment and to improving and optimizing the recovery of needed materials from the earth. New technologies must be developed to effectively ensure that our country can look forward to both an adequate and secure supply of minerals and a protected environment. This technology can best be developed through the programs that S. 2186 would reauthorize and significantly strengthen, while taking into account current budget restrictions. It continues federal support at a level below that previously authorized while increasing the states' and industry's responsibilities. The proposed legislation authorizes total appropriations that are less than half the original authorization for the period 1978-1984. Such lower level must have a negative effect on the results of the Institutes, but other facets of S. 2186 serve to offset the lower funding by increasing state matching fund requirements and better defining performance standards and program direction.

A key point in the proposed legislation is that Institute eligibility requirements have been significantly strengthened. In order to remain qualified, the Institutes must provide evidence of a substantial program with a demonstrated history of achievement, an accredited program or evidence of equivalent capability; institution commitment; and significant industrial cooperation. These requirements will require dedicated effort on the part of the participating universities and colleges; effort that will translate into new and innovative technology and a steady stream of qualified personnel.

Further, the existing advisory committee makeup is modified by this legislation to include representatives from the mineral industry and the academic community, as well as the federal government. This modification will go far to encourage cooperation and improve the quality and relevance of decisions on the research agenda.

The Committee will also be charged with developing a much needed national plan for research and development in mining and mineral resources, recommending a program to implement that plan, and determining eligibility of institutes to participate.

The Mining and Mineral Resources Research Institutes program fulfills the mandate under which it was created. S. 2186 ensures continuation of the program, while providing for adjustments necessary to keep the Institutes efficient and effective.

If the nation's mining and minerals industry is to remain competitive and strong it must continue to attract qualified technical manpower and utilize new mining and processing methods and technologies. The support provided by the institute program is essential and realistic. The American Mining Congress supports a reauthorization of the program as well as enactment of the provisions contained in S. 2186 that will significantly strengthen the program.

The nature of the mineral problems that the nation now faces warrant maintenance of the program and, to the extent possible, adequate funding to meet the need.

Senator **WARNER**. I thank you, Mr. Thompson, for your contribution and patience in attending this hearing.

The record will remain open for 2 weeks thereby providing the Senators the opportunity to submit questions to the witnesses and other Senators to contribute their statements and other material to this record.

Mr. Grandis is our final witness and he represents the Environmental Policy Institute.

STATEMENT OF EDWARD GRANDIS, DIRECTOR, CITIZENS MINING PROJECT, ENVIRONMENTAL POLICY INSTITUTE

Mr. **GRANDIS**. Thank you, Senator. It is a pleasure to be here today. My name is Ed Grandis. I am the director of the Citizens Mining Project with the Environmental Policy Institute in Washington. As this committee knows, and, Mr. Chairman, we have worked very actively since 1977 with this committee and Congress and the States and citizens to have this mine law fairly implemented. Within that was title III. We very much supported title III as implemented. We encouraged citizens to participate in title III and we worked very closely to make sure the universities received funding under that title.

Today, we would also like to say that while we support this legislation to carry out that intent, we do have some reservations and as my testimony indicates, the reservations are solely in section 9 and various subsections. They relate to the makeup of the committee. Just briefly stated, we would like to see the makeup of the committee expanded to include one of the original purposes, which was a working miner.

We believe that someone who actually works in the mining industry, whether it is above or underground, has certain expertise that could help in directing this committee in what type of research is needed and to examine projects that are proposed.

We also would like to encourage that a native American be added to this committee, because we believe there is significant energy resources on native American land and we think that they should share in this and could be very helpful in this process.

We would also like to see a representative of the environmental community participate on this committee. There was such a representative on the original committee and I believe the record shows this individual was a help to the committee and in looking at projects. We believe that there are responsible scientists and academic individuals and others who have legal and scientific training in that community that could be of help to this committee.

Moving on, one of our other concerns in this section deals with the exemption from the Federal Advisory Committee Act and while we share the concern that parts of that Act may cause a problem with the implementation of this committee, particularly in the area of conflict of interest, we would like to work with this committee and others to resolve those conflicts, but at the same time there are certain provisions that deal with notices of meetings to be made available to the public, minutes to be kept during those meetings to be made available to the public and other types of information-gathering that we think that there is no intention to keep the public from having that information, but at the same time we think that the Federal Advisory Committee Act would apply.

So we would like to work with the committee in trying to nail down those specific provisions which may not be suitable for this legislation.

Finally, before closing, the last area of concern we have deals with the nature of a research and development plan that is suggested also under section 9. Our concern there is that we think it is in the best interest that a plan be utilized if the plan is to help the committee determine what type of projects fall under their authority and what type of projects they felt would be most worthy of study.

But we are a bit concerned with the way the term development could be interpreted by future administrations or others who may not be here today in working with this legislation and that if the research and development is suggestive of typical R.&.D., we perhaps have no concern if that were to be so stated in the report.

But there could be a concern that the term development could mean that perhaps a Federal land use plan for developing minerals would be developed by the committee. I think there are a number of interests, including States, other industry, other environmentalists, other Congressmen and Senators may have that this committee may not be quite broad enough to develop in a national plan in a sense for developing these mineral resources.

But once again, it could be just a lack of my . understanding the intent of that provision and I would just like to say that I am willing to work with this committee and others in resolving those differences and make this bill move speedily along and getting it approved.

Thank you very much.

[The prepared statement of Mr. Grandis follows:]

ENVIRONMENTAL POLICY INSTITUTE

S. 2186

WRITTEN STATEMENT

By

EDWARD GRANDIS

for the

CITIZENS MINING PROJECT

before the

Subcommittee on Energy and Mineral Resources

Committee on Energy and Natural Resources

February 10, 1984

218 D Street, S.E., Washington, D.C. 20003 (202) 544-2600

ENVIRONMENTAL POLICY INSTITUTE

S. 2186 - STATE MINING AND MINERAL RESOURCES RESEARCH INSTITUTE PROGRAM

Chairman Warner, and members of the Senate subcommittee on Energy and Mineral Resources I want to thank you for the opportunity to testify today regarding S. 2186.

My name is Edward S. Grandis and I am Director of the Citizens Mining Project of the Environmental Policy Institute.

EPI was founded in 1974 to influence national policy on energy and the environment by research, public education, litigation, and lobbying in response to environmental threats of local, national, and international significance. We are a national information center for government, industry, the media, labor unions, and hundreds of local citizen organizations. Our goals are consistent with job growth, energy security, and safe workplaces and communities.

Today we want to present our views on S. 2186. Let me begin by saying that we strongly supported Title III of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). We wish we could support the present bill with as much enthusiasm. However, while we support the intent of S. 2186 to continue funding the Mineral Institutes program, we have significant reservations regarding certain provisions of the bill. These are:

1. Section 9(a),
2. Section 9(e), and,
3. Section 9(f).

EPI is on record supporting government financial support for mining and minerals research, but when federal dollars are involved, we are concerned that adequate federal oversight be provided to ensure appropriate accountability by the recipient.

Therefore, the Committee created by the legislation should reflect broad public respresentation. We recommend that the classification of board members be expanded to include a working miner (as provided in the orginial authorization), a Native American, and a qualified representative of the environmental community. We support appointment of such representatives of the public by the Secretary in an open manner that excludes the potential for undue influence by private special interest organizations. Additionally, the legislation should specifically require that the Assistant Secretary be designated on the basis of having no minerals or mining development responsibilities within the Departent of Interior.

As drafted, we oppose section 9(e). I have been unable to ascertain how this complies with the original authorization. While we support the Committee approach in determining Institute eligibility, we do not agree that this body is eligible to develop a national plan for determining research and development in mining and mineral resources. We would appreciate further information and clarification of the intent and boundaries of this subsection.

Section 9(f) should be omitted. There is no public purpose served by insulating this Committee or its actions from the scrutiny of the Federal Advisory Committee Act (5 U.S.C. App.).

We have several other concerns, including the need for language providing financial support to Native Americans in their minerals and mining research needs. We will share our concerns with the Subcommittee staff.

I want to once again thank this Subcommittee for this opportunity to testify. If the members of the Subcommittee have any questions, I will be happy to try to answer them. Thank you.

Senator **WARNER**. Thank you very much, Mr. Grandis.

If there is no further testimony, the hearing is adjourned. The record will remain open for 2 weeks. I thank each of the witnesses for attending and others and I hope you have a safe journey back.

[Whereupon, at 11:10 a.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses of Witnesses to Additional Questions

SCHOOL
OF
MINES AND
ENERGY
DEVELOPMENT

The University of Alabama Box 6282 University, Alabama 35486 Tel 205/348-4520
ACTS 243-4520

March 13, 1984

Mr. John W. Warner
Chairman, Subcommittee on
Energy and Mineral Resources
United States Senate
Washington, D.C. 20510

Dear Senator Warner:

I apologize for the delay in responding to your letter of February 15, 1984 concerning S. 2186. I was out of town when your letter arrived and have just returned.

I will attempt to answer your questions succinctly. The answers are from my own perspective and may not reflect the view of the other members of the Universities Panel which appeared before your subcommittee. My responses are:

1. Federal funding is absolutely essential to maintain the Institute program. State and industry support will rapidly diminish if Federal funding is withdrawn. In Alabama, state support for the Institute exceeds the Federal funding. Recently the State and the University have announced plans to build a 10 million dollar energy and mineral research center. The Institute program was a vital factor in our decision to build such a center. I doubt that we would have made such a commitment in Alabama without the presence of a successful Institute program. In my opinion, most of the other states which have Institutes share the view that the Federal funding is the necessary component to maintain strong state support of the Institutes.

2. I do support the eligibility criteria imposed under section 10 of S. 2186 as originally proposed. These criteria are rigorous enough to require a significant commitment on the part of the state and the university to a quality educational program in mining or mineral engineering. The standard of quality to be applied is the presence of

an accredited engineering program in one of these areas or its equivalent. This strengthens the Institute program over the present PL 95-87 which is somewhat vague with respect to eligibility. This very vagueness has contributed to the number of Institutes now in existence. The criteria in S. 2186 will have the effect that some of the Institutes will have to upgrade the program of education in mining or mineral engineering or be excluded. The net result will be a stronger Institute program either through upgrading or pruning away of weak Institutes.

3. The Accreditation Board for Engineering and Technology (ABET) is recognized by the U.S. Commissioner of Education and the Council on Postsecondary Accreditation as the national accrediting authority concerning the quality of engineering and engineering technology programs offered by educational institutions in the United States. The Committee on Engineering Schools established accreditation procedures in 1933; these procedures were approved by the Engineers' Council for Professional Development that same year. Members are chosen through the professional engineering societies. To be considered for accreditation, engineering programs must be designed to prepare graduates for the practice of engineering at a professional level. The accreditation process includes a written questionnaire and an on-site visit. The questionnaire is supplemented with a report of the on-site visit by a carefully selected team representing ABET and its participating bodies.

4. Mineral and mining engineering programs must follow criteria defined by the professional society (The American Institute of Mining, Metallurgical, and Petroleum Engineers) and meet ABET qualifications to be accredited.

5. To have a mineral engineering program accredited by ABET is most absolutely and definitively standard practice for departments with high scholarly, productive standards.

6. I know of no disincentives for seeking accreditation if a university is in pursuit of academic excellence.

7. I regard the Institute program as a working partnership between the Department of Interior and the universities where the Institutes are located. In that context, then, it is appropriate for universities to be represented in the Committee on Mining and Mineral Resources Research. The conflict of interest question seems to be almost trivial when you consider the large benefit of more effective communication between the Department of Interior and the universities. In any case, the universities' vote on the Committee is only three out of a total of twelve.

8. The Committee as constituted in S. 2186 does reflect broad public representation, in that the federal government, the interested universities, and the mining industry are represented. I have no objection to including a representative of the environmental community who is well qualified by training and has working knowledge of the mining and mineral industries. I do not see where the qualifications of a working miner or a Native American are germaine to the functions of the Committee.

9. The Federal Advisory Committee Act would allow the Committee more flexibility in the scheduling of meetings. The Committee needs this flexibility while maintaining a readily accessible record of their deliberations.

   The conflict of interest treatment under this Act would remove the burden of personal financial disclosures for Committee members from the universities and industry. More importantly, being a Committee under the Act promotes a better working relationship among the Department of Interior, the mining/mineral industry, and the universities. In my view, a co-operative partnership of the three parties is required for the Committee to function effectively. In the aggregate, the universities and industry bring more physical and human research resources to the Institute program than the Bureau of Mines can provide. It is my contention that the Bureau needs the input and participation of both the universities and the mining/mineral industry.

10. The Institute program as it would be conducted under the provisions of S. 2186 would be supportive of, and beneficial to, the mining and mineral industries throughout the country. Because of this broad support, I see little, if any, need for additional research support for Native Americans to conduct minerals and mining research. I do not mean to exclude Native Americans from participating in this Institute program either as students, faculty, or researchers.

If you have any further questions or desire additional comment on any point I have raised in my response, I will be glad to reply. Thank you for your attention to a matter of considerable concern to me and of considerable benefit to the national mineral industries.

Sincerely,

J. Read Holland

J. Read Holland
Director

JRH:va

IMMRRI

Illinois Mining and Mineral Resources Research Institute

Southern Illinois University at Carbondale
Carbondale, Illinois 62901
(618) 536-5521

February 23, 1984

EXECUTIVE COMMITTEE

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The Honorable John W. Warner, Chairman
U. S. Senate
Energy and Mineral Resources Subcommittee
of the Energy and Natural Resources Committee
SD-308 Dirksen Senate Office Building
Washington, D. C. 20510

Dear Senator Warner:

I appreciate the opportunity you have provided for me to answer questions related to testimony presented to the Subcommittee on Energy and Mineral Resources at the February 10, 1984 hearing on S. 2186. In the following sections, I will answer these questions to the best of my ability.

1. Question: This Administration has asserted time and time again that Federal funding is unnecessary to maintain the Institute program. Do you agree with this? Please explain.

   Answer: I disagree with the Administration's position. In general, according to the National Academy of Sciences, President Reagan's initiative to shift the responsibility for university research from the public to the states and private sector is lagging. Although I believe it is important that the state governments and the private sector assume a larger share of the responsibility for funding education and research programs, this transition, if successful, must occur gradually over a period of time. S. 2186 provides for this gradual transition by increasing the university cost-sharing from one to one to two to one. In addition, I believe if evidence of federal interest and support in a program such as MMRRI is present, it will serve as a stimulus to states and private industry to provide additional support. Furthermore, federal funding of the mineral institutes serves to link the 31 institutes into a network insuring an integrated program. In addition to the linkage among institutes, federal funding also insures a partnership between the federal funding agency and the universities participating in the program. This linkage enables the federal government to play an important role in establishing the focus of the program.

2. Question: Do you support the eligibility criteria imposed under section 10 of S. 2186? Please explain.

Answer: I support numbers 1, 2, and 3 of the eligibility criteria in Section 10. I believe that Criterion 4, however, is unfairly biased against those universities that do not have an ABET accreditation in mining or minerals extraction. Since eligible subjects of research and training in the MMRRI program (see page 3, lines 11 through 18) involve other disciplines than mining engineering, it seems that too much emphasis is being placed on ABET accreditation. Although Criterion 4 offers an alternative to the ABET accreditation, it is stated in such vague terms ("evidence of equivalent institutional capability") that, without this accreditation, an institute's eligibility would be left totally to the discretion of a Committee. If the ABET criterion is retained, the language of the alternative for non-ABET institutes should be made more specific. I believe that the amendment that I introduced in the Senate hearings, which calls for a participating non-ABET university to have a strong program in one of the disciplines of mining or mineral resources would alleviate the vagueness and should be substituted for the present language. It is important to note that because many of the present institutes do not even have a department of mining engineering or a department of minerals extraction, accreditation in these categories is not even a possibility. Instead these institutes qualified for participation based on their capabilities in extractive metallurgy, geology, petroleum engineering, or combinations of relevant disciplines.

3. Question: What is the Accreditation Board for Engineering and Technology (ABET?) Who set it up? Who chooses its members? What are its accreditation standards? How does the accreditation process work?

Answer: The Accreditation Board for Engineering and Technology (ABET) formerly known as Engineers' Council for Professional Development (ECPD) was founded over 50 years ago by the professional associations of practioners in engineering and technology. About 19 professional engineering and technological societies all over the U. S. nominate members to ABET. They serve through various commissions to set standards and insure quality control of engineering and technology programs offered by educational institutions in the nation.

The Engineering Accreditation Commission (EAC) of ABET is invested with the curricular and criteria setting responsibilities for accrediting programs in engineering and technology. ABET is recognized by the U. S. Commissioner of Education and the Council on Post Secondary Accreditation (COPA) as the national accrediting authority of the engineering and technology programs offered by educational institutions in the United States.

This national accrediting body acting in the interest of the profession and the public establish standards for each program.

In general, to achieve accreditation, a curriculum must be consistent with nationally recognized standards regarding content, competencies and skills. The curriculum must be written in such a way as to be rational and clear. The information presented on paper must accurately reflect the experience of the students as well as the behavior of the faculty. The program must also have adequate resources and qualified faculty members. The process and procedure for getting accreditation is explained in the answer to question number four.

4. Question: What procedure must a university go through to have its mineral engineering program accredited by the [ABET]?

   Answer: In order to get the mineral engineering program accredited by [ABET], a rigorous self-study will be undertaken. The self-study may include reference to the philosophy of the program, the theoretical framework upon which the curriculum is built, curriculum contents and program terminal objectives. Following the study, a report is issued detailing the faculty's critique of its own curriculum and recommendations to improve them.

   After the implementation of the recommendations, a formal application will be placed with ABET. Other procedures followed include submission of a questionnaire, site visit by the accrediting team and the issuance of the team report on its recommendations. Once the program has been accredited, an on-going evaluation of the program is usually conducted in a three to six year cycle.

5. Question: Is it standard practice to have one's mineral engineering program accredited by ABET?

   Answer: Because I have insufficient data on the number of schools with mineral engireering programs, I cannot give a definitive answer to this question. However, it is my belief that being accredited by ABET is either a long or short-range objective of any engineering program.

6. Question: If a school's program would appear eligible for accreditation, are there any discincentives for doing so?

   Answer: In general, an ABET accreditation is an asset to an engineering program. However, in the early years of a particular program's existence, when the Department is in the process of building the program, it may be beneficial-for the accreditation application to be delayed. Although the quality of instruction may be good, the number of faculty employed in the program and the number of students majoring in the discipline may be too small to qualify. Oftentimes, when a university institutes a new program of study, resources invested in the early years of the program may be smaller, and designed to grow over a period of years. Thus, although in the long run there would not be a disincentive to acquire ABET accreditation, it may be to the institution's advantage to temporarily delay seeking the accreditation while it concentrates in the early years of the program establishing its quality.

7. Question: The Interior Department's testimony reflects that the Committee on Mining and Mineral Resources Research established by Section 9 of the bill, which would include three university administrators, clearly raises the specter of conflict of interest. Would you comment on this concern?

Answer: There is a requirement in the Mineral Institutes Program for each participating university to provide cost sharing of the Federal contribution with funds obtained by the university from state and private sources. Frequently, this funding is provided from the university's base budget or from an overhead account. Because of this cost sharing requirement, the university community should have a voice in the administration of the program and should therefore be represented on the Committee on Mining and Mineral Resources Research. I recommend that, if three university administrators are selected, one represent non-fuel mineral interests, one represent coal interests, and the third represent oil and natural gas interests. Also at least one of the university administrators should come from an institution that has only an allotment grant and is not affiliated with one of the generic centers.

8. Question: Do you believe that the Committee, established by Section 9 of the bill, reflects broad public representation? Should the Committee, in your view, be expanded to include a working miner, a Native American, and a qualified representative of the environmental community?

Answer: The recommendation that the membership of the Committee be expanded to increase public representation has merit. However, singling out a working miner and a Native American to be representatives is not a good approach. A working miner would probably not have the knowledge and interest to contribute effectively. Native Americans should not be given preference to members of other minority groups such as blacks and hispanic Americans. Consideration should be given to selecting an individual from the Equal Opportunity Office from the Department of Labor to represent the interests of minority groups and working miners. An alternative would be to obtain representation from the AFL/CIO national labor organization to represent working miners. I concur with the recommendation that an official from an environmentalist group be invited to serve.

9. Question: Could you explain the pros and cons of being a Committee under the Federal Advisory Committee Act?

   Answer: The legislation presently states that the Federal Advisory Committee Act shall not apply to the Committee, but no explanation or justification is given. Furthermore, no testimony was presented at the hearing on February 10, 1984 which provided a rationale. Unless this justification is provided by proponents and written into S. 2186, I recommend that Section 9(f) be deleted. I have attended meetings of the Energy Research Advisory Board commissioned by the U. S. Department of Energy. It is covered by the Federal Advisory Committee Act. I could not detect any problems caused by the openness of the meetings.

10. Question: Do you believe that there is a need to provide financial support to Native Americans in their minerals and mining research efforts?

    Answer: To the best of my knowledge, all universities now participating in the Mineral Institutes Program are sensitive to the need to provide equal opportunity to Native Americans and members of other minority groups. A substantial number of Native Americans are enrolled in universities which house the mineral institutes in states west of the Mississippi, such as Oklahoma, New Mexico, and the Dakotas. I do not feel that there is justification to provide special financial support to Native Americans as long as Native American students are provided an equal opportunity to benefit from the Mineral Institutes Program.

I hope that these answers to your questions are satisfactory and useful.

Sincerely,

James H. Swisher

James H. Swisher
Director

UNIVERSITY OF MINNESOTA
TWIN CITIES

Mineral Resources Research Center
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Minneapolis, Minnesota 55455-0205
(612) 373-3341
TWX 910 576 2955

1984 MAR -1 [illegible] 5:22

February 27, 1984

Senator John W. Warner
Chairman, Subcommittee on Energy
and Mineral Resources
United States Senate
Washington, D.C. 20510

Dear Senator Warner:

Thank you for your letter of February 15, 1984 requesting a response to ten questions arising from the testimony presented on February 10. My replies, numbered to correspond to the numbering of the questions, are as follows:

1) I am convinced that the Institute program cannot survive without federal funding. Therefore, I cannot agree with the Administration position. The main value of the federal support is its flexibility and resulting potential for use as seed funding, an area traditionally difficult to fund in contracts. The federal funding, therefore, provides a route to innovation not readily accessible by any other means.

2) Yes. After considerable debate amongst the Mineral Institute directors an ammendment was offered at the hearing. This was intented to provide stricter eligibility criteria than covered by the original wording. However, I believe that the majority of the directors would be happy with the original wording.

3) ABET is a national organization representing professional associations in engineering disciplines, e.g. American Institute of Mining, Metallurgical and Petroleum Engineers, American Institute of Chemical Engineers, etc., etc., and is reponsible for maintaining the professional

standards of engineering disciplines by reviewing and accrediting academic programs. Each discipline has its own education committee which nominates members for the ABET teams assembled to visit universities.

The committees and teams are drawn from all professional areas, e.g. academic, industry, consulting, etc. There is a continual review process which defines the criteria required for accreditation covering such items as courses offered, number and qualifications of faculty, equipment and facilities, support personnel, etc.

The process operates by site visits made by an ABET visiting team to review several engineering programs at a given university site. At least one individual member of the team is responsible for a given program, e.g. Mining Engineering, and he will interview faculty, students and staff in the department to determine if the required criteria are met.

4) For a new program the university advises ABET that the program is in place and invites an accreditation visit.

5) Yes.

6) No.

7) The question of conflict of interest cannot be taken seriously. We are dealing with an advisory panel at the top level of professional responsibility. The input of leading academics is obviously necessary to fulfill the broad objectives of the committee. If a question arose that was narrow enough to involve a particular member's institution it is normal professional practice for the individual to excuse himself from the discussion.

8) Yes. I do not believe that adding to the committee would be productive or necessary.

Senator John W. Warner
Page 3
February 27, 1984

9) I am not sufficiently familiar with the Federal Advisory Committee Act to be able to comment.

10) I am not aware of any mining and mineral research activities of Native Americans. However, I would recommend that concerns in this area be focused through the NASULGC committee on University-Native American Cooperation.

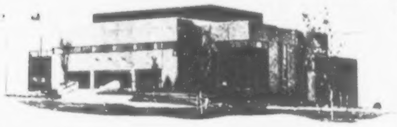
Please let me know if I can be of any further service on these or related topics.

Yours sincerely,

K.J. Reid

Dr. K. J. Reid
Professor and Director
Chairman, NAMID

University of Kentucky
INSTITUTE FOR MINING AND MINERALS RESEARCH
Kentucky Center for Energy Research Laboratory



Iron Works Pike • Box 13015
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(606) 252-5535
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February 21, 1984

The Honorable John C. Warner, Chairman
Subcommittee on Energy and Minerals Resources
Room SD 306 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Senator Warner:

I presented testimony to the Subcommittee on the 10th of February and was asked a question that I would like to have included in the written record. I was asked the following question: Does your institute in Kentucky need the perfecting amendment discussed by Mr. Swisher? My answer to this question is the following: Because the University of Kentucky does not have an accredited mining or minerals extraction engineering program, eligibility as defined under Section 10 would be determined by a U.S. Department of the Interior committee with reference to our expertise only in mining and mineral extraction engineering. (Kentucky and fourteen other states were judged eligible without having accreditation in a mining and minerals extraction engineering program in 1977 based on the presence of four faculty members in mining engineering and strong programs in other mineral resource fields.) Section 10, (4) language removes all non-mining engineering mineral resource fields from the eligibility criteria and thus implicitly suggests that the other areas are no longer important. As a result, the U.S. DOI committee could interpret this in such a way that Kentucky could be judged ineligible. A recent communication from Robert Horton, Director of the U.S. Bureau of Mines, indicates how this may be used (attachment 1). He is requesting information from the Institute directors which makes reference only to accredited activities of the various mineral institutes. The letter from Director Horton implies that this is the only important activity of the program.

The proposed perfecting amendment indicates that if the program is not accredited by the Accreditation Board for Engineering and Technology (ABET) or an engineering program is not presently involved in mining or mineral extraction but the institution has a substantial education research program in at least one discipline in mining or mineral resources, they can be judged eligible. If the committee decided to use ABET accreditation as the main criteria, Kentucky and fourteen other Mining and Mineral Resources Research Institutes (MMRRI) could be judged ineligible.

This focus only on mining and mineral extraction engineering is not consistent with Section 1 (b), lines 11 through 23 of the program's authorization which states:

> "The subjects of such research, investigations, demonstrations, experiments, and training may include exploration, extraction, processing, development, production of mineral resources, mining and mineral technology, supply and demand for minerals, conservation and best use of available supplies of minerals, the economic, legal, social, engineering, recreational, biological, geographic, ecological, and other aspects of mining, mineral resources, and mineral reclamation; having due regard to the interrelationship with the natural environment, to the varying conditions and needs of the respective States, and to mining and mineral resources research projects being conducted by agencies of the Federal and State Governments, and by other institutes."

The University of Kentucky's Institute for Mining and Minerals Research program is a strong mining and mineral resources education, research and service program and the only reason this clarification is sought is to insure that through a technicality the University of Kentucky would not be eliminated from the MMRRI program. The federal component of our mining and mineral resources program has been too important for us to not seek this clarification.

Sincerely,

Lyle V. A. Sendlein
Professor and Director

/mrb

Attachment

United States Department of the Interior

OFFICE OF THE DIRECTOR

BUREAU OF MINES
2401 E STREET, NW.
WASHINGTON, D.C. 20241

February 6, 1984

Dr. Lyle V. A. Sendlein
University of Kentucky
Iron Works Pike
P. O. Box 13015
Lexington, Kentucky 40512

Dear Dr. Sendlein:

At the February 2 hearing before the Subcommittee on Energy and the Environment of the House Committee on Interior and Insular Affairs, we were asked to provide data on alternative sources of support for mineral sciences and engineering at institutions receiving support through the mineral institutes program. For example, the September 1983 Special Issue of Earth and Mineral Sciences from Pennsylvania State University gave the following information for the $20.8 million operating budget for their College of Earth and Mineral Sciences which includes all of the Penn State mineral-related programs. For instruction, $3.5 million was received from the Commonwealth, $3.2 million from student tuition and $0.9 million from private gifts and grants. To support research, $0.8 million was received from the Commonwealth, $11.6 million from Federal grants and contracts, and $0.8 million from private sources.

Please complete the enclosed sheet, listing similar data for all mineral-related programs for which curricula have been accredited by the Accreditation Board for Engineering and Technology (ABET), sign your name and return to the Office of Mineral Institutes no later than February 29, 1984, so that we may promptly inform Congress.

Sincerely,

Robert C. Horton
Director

Enclosure

RECEIVED
FEB 0? 1984
IMMR

MINERAL-RELATED OPERATING BUDGET

FOR

____

School Year 83-84 or ____________

$ (millions)

Instruction

State ____________

Tuition ____________

Private gifts and grants ____________

Research

State and State agencies ____________

Federal grants and contracts ____________

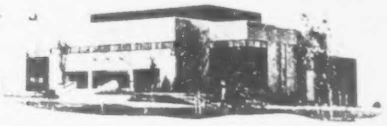
Private gifts, grants, and contracts ____________

Other (specify) ____________

____

Signature of Mineral Institute Director

University of Kentucky
INSTITUTE FOR MINING AND MINERALS RESEARCH
Kentucky Center for Energy Research Laboratory



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TWX [illegible]

February 28, 1984

The Honorable John Warner
Chairman, Subcommittee on Energy and
Mineral Resources
Room SD 306 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Senator Warner:

I appreciated the opportunity to testify before your subcommittee on S. 2186 and respond to your questions related to that testimony. I will respond to your questions by number in your letter dated February 15, 1984.

1. The Administration has not been willing to fund the Mining and Mineral Resources Research Institute (MMRRI) program since President Reagan has taken office. Although I can understand the enormous task the President has in trying to determine which programs should carry Federal support, I disagree with his position on this program because I believe the country will reap many times the $9.4 million invested in this program in increased technical capability, an increase in our competitive position in the mining and mineral international market, and improve our position relative to strategic minerals development and management. Likewise I believe this program provides a focal point for industry, government and universities in the mineral sector that did not exist before the program was started in 1977. The mineral industry of this nation is not mature enough to support the proper level of research and training that most other industries are able to support and I believe that for this reason alone the program should be partially supported by the Federal Government.

2. On the question of eligibility criteria imposed in section 10 of S. 2186, I have written a separate answer to you and have included a copy of that letter.

   I am sure the questions you have asked relative to ABET accreditation will be answered by each of us in very much the same way, however, I would like to point out that you may have missed the point of concern. There is much more to the mining and mineral resource problems than can be addressed by the engineering sciences in a meaningful way and therefore to only use this measure for the program is incomplete and rather narrow thinking. The programs in mining and mineral extraction engineering covered by ABET accreditation have been so for many decades and the problems facing the mineral industry have not been resolved, and indeed we find ourselves non-competitive in the world marketplace. So the issue is not whether a program should be ABET accredited or not, but what other programs should be included to broaden our education and research to become competitive. I believe the MMRRI program has started us on the track to do this and I believe the wisdom of the Congress came through when the additional language was included in the original bill that made the program more than just support for the mining and extraction engineering programs in this country. I realize those traditional mining schools would like to see all of the funds go to their programs, however, I do not believe they did the job in the past and cannot do it in the future without the interaction with other programs at other universities that the MMRRI provides.

3. The Accreditation Board for Engineering and Technology has established as its purpose to "be the promotion and advancement of engineering education with a view to further the public welfare through the development of better educated and qualified engineers, engineering technologists, engineering technicians and others engaged in engineering or engineering related work". The ABET was first proposed by the Committee on Engineering Schools in 1933. The ABET is an organization composed of engineering societies and engineering-related societies who are interested in the maintainence of quality in the engineering curricula in the United States. Membership is obtained by application to ABET which has admission standards and review of applicants. Any institution of higher education may request the Engineering Accreditation Commission to determine whether one or more of its programs meet the approved criteria for accreditation.

4. By explaining the process one can see how the process works. The first step is an evaluation of the program based on analysis of data submitted by the institution to ABET in the form of a questionnaire. The second step is an on-site visit by a carefully selected team representing ABET. The purpose of the visit is threefold: 1. It should assess factors that cannot be adequately described in the questionnaire. The intellectual atmosphere, the morale of the faculty and the students, the caliber of the staff and student body, and the character of the work performed are examples of intangible qualitative factors that are difficult to document in a written statement, 2. the visiting team should help the institution assess its weak as well as its strong points, 3. other things such as educational programs and degrees conferred, basis of the requirements for admission of students, number of students enrolled, physical facilities, finances, etc. A report is prepared and submitted to the Engineering Accreditation Commission for their review and approval. The institution is notified of their findings and accreditation is granted or denied.

5. Yes

6. No

7. The Committee as proposed in the legislation is designed to be a working committee to improve the interaction between government, industry and universities in the area of mining and mineral resources. It seems only logical that those universities involved in the mining and mineral resources education and research programs be represented on the committee. It is my opinion the purpose of the committee is not to manage only the mineral institute program, but to address the larger problems facing the U.S. mineral resource problems.

8. It appears to me that the selection of committee members should be on a broad basis such as industry, government and university and if the industry chooses to be represented by a working miner, then it should be in that way one is selected. I do not believe that one's race should be a criteria for membership to the committee. I would think that Native Americans will be represented in all three groups: industry, government and university. I like to think that as a university faculty member I am interested in the environmental issues just as government members would be also. I believe that this representation can be provided under the industry sector as well by selecting a service industry representative as one of the industry members of the committee.

9. I believe other members of our group have researched this topic for you and I will not repeat it here.

10. I have not researched this issue because Kentucky does not have an identified Native American population. No data is available to provide preference for Native Americans as we do for blacks. We do not have lands designated as Indian lands in Kentucky or any organized group of Native Americans. In discussion with my colleagues from western schools I have learned that they are treated like any other minority group and have opportunities to pursue education and training in the mining and mineral resource fields. I understand that there are active Native American businessmen in the mineral industry and that they receive the same support that other industries do.

I hope these answers will be of assistance to you.

Sincerely,

Lyle V. A. Sendlein
Professor and Director

/mrb

Attachment

COLLEGE OF ENGINEERING

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061 2890

DEPARTMENT OF MINING AND MINERALS ENGINEERING [illegible] TELEX [illegible]

February 23, 1984

The Honorable John W. Warner, Chairman
Subcommittee on Energy and Natural
Resources
Committee on Energy and Natural
Resources
United States Senate
Washington, D.C. 20510

Dear Senator Warner:

This will acknowledge your letter of February 15, requesting a response to 10 questions concerning the legislative hearing on S. 2186 held on February 10, 1984, under your effective Chairmanship, Subcommittee on Energy and Mineral Resources.

It was indeed my pleasure to present a statement to you and the Subcommittee on this bill, and your request to respond to the thoughtful and well-structured questions has been given serious consideration. As a result of your desire for a prompt response, my reply to the questions are enclosed for your use and hopefully will meet your needs. If you or your associates require additional information, please do not hesitate to contact this office by telephone for a prompt response to meet your pressing needs.

It was indeed my pleasure to appear before your legislative hearing, and I look forward to you and your associates in the Senate supporting and successfully passing this important legislation, which will do much for mining and minerals engineering in the Commonwealth, in the Appalachian Region and in the Nation.

With all best wishes.

Sincerely yours,

Dick

J. Richard Lucas, Head
Dept. of Mining and Minerals Engrg.

JRL/aad
Enclosures:
1. Responses to 10 Questions on S. 2186
2. Listing of Mining Institutes and Their ABET Accreditation Status in Mining and Minerals Engineering

February 23, 1984

RESPONSES TO 10 QUESTIONS CONCERNING S. 2186 AS REQUESTED BY THE HONORABLE JOHN W. WARNER, CHAIRMAN, SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES, LETTER DATED FEBRUARY 15, 1984.

1. Concerning the assertion by the Administration that federal funding is unneccessary in the maintenance of the mineral institute program, my response is one of strong disagreement with the statement based upon my observation of the mineral industry for many years. A responsible observer of the mineral industry in this country would agree that this industry would not and perhaps at this time could not maintain the mineral industry program. While many recognize the importance of mining and mineral research to the nation, this industry currently has been affected more so that other segments of the economy in the economic downturn of 1980-82, and the financial resources are not available to support even a modest program. The mineral industry during an international emergency becomes a stratagic and important industry supporting our national defence effort.

2. The eligibility criteria imposed under Section 10 of S. 2186 appears to be a position reached after much deliberation by responsible leaders in this field. However, some of the institutions, which consider themselves to be marginal in mining and minerals extraction, have become concerned that their institution may be affected by the review in the light of the proposed eligibility criteria and may fail to satisfactorily pass this review in a positive and constructive manner. The criterion that is quite definitive is accreditation by the Accreditation Board for Engineering and Technology (ABET) in mining and minerals extraction. Of the 31 mining institutes currently approved and in the program, 16 of these institutions have received ABET accreditation while 15 of the universities have not received ABET accreditation in mining or minerals extraction. In the latter category, some of these universities may be receiving in the near future ABET accreditation---Southern Illinois University-Carbondale, University of Kentucky, Ohio State University, University of Texas at Austin and the University of California. On the other hand, some states, which currently have a mineral institute at their land-grant university and are not substantial producers of minerals, have substantial influence in the Congress---Louisiana (Louisiana State University), Massachussets (Massachusetts Institute of Technology), Mississippi (University of Mississippi), Texas (University of Texas, at Austin) among others. For your information, I am enclosing a listing of the universities, which have mining institutes and are accredited by ABET, and those universities which are not accredited by ABET.

3. The Accreditation Board for Engineering and Technology (ABET) is a national accrediting agency for academic programs in higher education concerned with engineering and engineering technology. The Board has been established by the engineering profession and the active members are selected by the individual professional societies---American Institute of Mining, Metallurgical, Petroleum Engineers, American Institute of Electrical and Electronic Engineers, American Institute of Civil Engineers, American Society of Mechanical Engineers, American Institute of Chemical Engineers, and others. Accreditation standards

are established by the members of the Accreditation Board and its many committees with substantial input from professional engineering societies. It has established minimum criteria for undergraduate curriculum in a given engineering field. The following is the current curriculum balance required for accreditation by ABET:

1. 1/2 year full-time equivalent effort in mathematics beyond trigometry.
2. 1/2 year equivalent full-time effort in the basic sciences.
3. One-year full-time equivalent effort in the engineering sciences.
4. 1/2 year of full-time equivalent effort in engineering design.
5. 1/2 year of full-time equivalent effort in the humanities and social sciences.

Further, a minimum of faculty is required,and the number varies with the particular engineering field. The qualifications and the performance of the faculty are judged by their teaching, research, publication, and graduate training record. In short, if a faculty member is performing well in those responsibility areas, which means that he is productive in research and graduate training, then it is judged that he would be also an effective undergraduate teaching and faculty member.

The accreditation process begins with the appointment of a visitation team selected by a chairman, who consults an approved list of visitors in specified engineering disciplines that are provided by the professional society. The committee, which usually consists of one inspector or visitor per engineering discipline, visits the institution for 1 1/2 days of intensive observation and review based upon the review of a detailed report that has been submitted by the university and distributed to the various members of the inspection team beforehand. Individual reports by the inspectors are submitted on each visited engineering program to the chairman of the committee, who in turn adds comments and recommendations and forwards his report to the various committees of ABET, which consist of engineering professionals from the university community, the industrial community and other areas of the nation to make the final determination of accreditation. "Full accreditation" is for a six-year period and is received approximately nine months or more after the initial visit. Various stages of accreditation exist under which a program is considered to be accredited, and a category of "N/A exists, which means not accreditable.

4. The university, after it has graduated a class in a given engineering discipline, may request that ABET conduct an inspection or visitation to its campus with the objective of approving a given engineering program. Visits by an ABET team usually will be made in the fall quarter of each school year, and the final decision will be made by an ABET committee perhaps in the following late spring or early summer. Full disclosure on the curriculum and the college is necessary in this process. A program, with minimum standards and supported by the university, should be able to achieve accreditation after the graduation of at least one senior class.

5. Currently it is very common and standard practice to have a mineral engineering program accredited by ABET. Being accredited or not accredited is very important in the perception of many observers of the university scene and is equated with a given quality of achieving minimum standards in a given engineering program.

6. If an engineering program at a university appears to be eligible for accreditation, few if any disincentives exist for doing so, whereas many incentives are readily manifest for encouraging the pursuit of accreditation status.

7. The inclusion of three university administrators on the Committee of Mining and Minerals Resources Research Institutes, established by Section 9 of S.2186, pernaps could be considered as an opportunity for a conflict of interest. If the three members were carefully selected, this concern perhaps could be minimized. Further, if the three university administrators were associated with universities that were not involved in the mineral institute program, this would further reduce the apparent concern.

8. A committee, established by Section 9 of the bill, perhaps reflects a broad representation of appropriate backgrounds to focus on this specific discipline area. However, the addition of a working miner, a native American, and a qualified representative of the environmental community may be appropriate, but the effectiveness of such additions to the overall functioning of the committee over an extended period may not be significant.

9. I am not certain of the advantages and disadvantages of insulating a committee or its action from the jurisdiction of the Federal Advisory Committee Act.

10. I do believe that a need exists to provide financial support to native Americans desiring to pursue research in mining and minerals engineering. The academic leadership and faculty members, who have the responsibility of training future professionals in this field,were trained at a research university and received doctorate degrees such as the Doctor of Philosophy degree in mining and minerals engineering . Without critical financial support it is not possible for many Americans to continue graduate education for three additional years, which is required to obtain a Ph.D. degree. Because of this disincentive, few talented American students in the undergraduate program elect to pursue such a dedicated and difficult program because of the many disincentives that are apparent. One of the perceptions held by the students is that compensation in the academic world is substantially below compensation for equivalent responsibility in the industrial world. This perception is not the same in many other countries of the world whose government support graduate education and graduate research in their leading universities.

    As a result, a supply of trained Ph.D.'s exist in mining and mineral engineering in other countries of the world to meet their needs, but an insufficient supply of Ph.D.s in this field exists in this country because of the lack of a continuing and consistent program supporting graduate students and their research programs in this critical field. As a result, many faculty members in American universities in this field were associated with graduate training at a foreign university or were a foreign student, who has trained at an American university for the Ph.D. degree. In any event, we are approaching a time when the leadership in the academic community of this nation in this important field may not be native-trained Americans, who are familiar with our culture and system, but foreign-trained immigrants, who are not familiar with our values, system and culture. In my opinion, perhaps 50% of the faculty or more in mining and minerals engineering may be classified as non-native Americans, who received their training elsewhere or who immigrated to this country for their university training. This ratio is not considered desireable for the long term to achieve development and progress of sound pedagogy and academic programs, whose function is to improve and advance the training of professional research personnel in mining and minerals engineering.

MINING AND MINERALS RESOURCES RESEARCH INSTITUTES

ABET Accredited
in Mining or Minerals Extraction

- University of Alabama
- University of Alaska
- University of Arizona
- Colorado School of Mines
- University of Idaho
- Michigan Technological University
- University of Minnesota
- University of Missouri - Rolla
- Montana College of Mineral Science and Technology
- University of Nevada, Reno
- New Mexico Insitute of Mining and Technology
- Pennsylvania State University
- South Dakota School of Mines and Technology
- University of Utah
- Virginia Polytechnic Institute and State University
- West Virginia University

Not ABET Accredited
in Mining or Minerals Extraction

- University of California
- Georgia Institute of Technology
- *Southern Illinois University-Carbondale
- *Purdue University
- *Iowa State University
- *University of Kentucky
- *Louisiana State University
- *Massachusetts Institute of Technology
- *University of Mississippi
- University of North Dakota
- *Ohio State University
- *University of Oklahoma
- University of Texas at Austin
- University of Washington
- University of Wyoming

*Supports proposed amendment

NATIONAL
COAL
ASSOCIATION

COAL

March 7, 1984

Honorable John W. Warner
Chairman
Subcommittee on Energy and
 Mineral Resources
Committee on Energy and
 Natural Resources
United States Senate
Washington, D. C. 20510

Dear Mr. Chairman:

In response to the questions set forth in your letter of February 13, 1984, concerning S. 2186, I submit the following:

1. Without a thorough knowledge of each school's academic program, it is difficult to determine whether any of the existing Institutes are not qualified. The number presently being funded does bring into question whether there are too many Institutes being funded. But, certainly, there must be a serious effort to make certain that the establishment of additional Institutes be strictly limited, especially in light of the present budgetary constraints.

2. Yes, the eligibility criteria contained in S. 2186 are somewhat narrower and, as a result, more realistic than the existing criteria. The amendment proposed by Dr. James Swisher is much broader than S. 2186 and would permit almost any college or university to qualify as an Institute and this would be unacceptable.

3. It is unlikely that the new eligibility criteria will reduce the number of existing Institutes to any significant degree. There will be no effect on existing Institutes prior to October 1, 1986. It will, however, make it more difficult for new Institutes to be established. The new criteria do not require an accredited engineering program as some mistakenly believe; the language makes it clear that a school would still be eligible if it presents evidence of equivalent capability.

4. I do not have personal knowledge of any schools opposed to the new criteria.

5. The national plan would only be a recommended course of action and I believe the Section 9 committee would be qualified to develop a plan for research and development in mining and mineral resources. The committee would be made up of qualified academicians, government officials and industry personnel ex-

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perienced in mining and minerals.

6. I believe the proposed makeup of the committee is acceptable. Industry is included because it is qualified to ascertain its research needs and the training required for engineering and technical personnel. The limited purpose of the legislation does not require other representation.

If I can be of any further assistance in this matter, please do not hesitate to let me know. I appreciate your kind consideration of our views and the opportunity you have given me to present them to your subcommittee.

Yours truly,

Robin T. Turner

Robin T. Turner
Vice President - Administration
North American Coal Corporation

NEWMONT MINING CORPORATION
200 PARK AVENUE
NEW YORK, N. Y. 10166

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J. E. THOMPSON
PRESIDENT

February 22, 1984

The Honorable John W. Warner
Chairman, Subcommittee on Energy
  and Mineral Resources
Committee on Energy and Natural Resources
United States Senate
Washington, D. C. 20510

Dear Mr. Chairman:

Thank you for the opportunity to elaborate on my testimony of February tenth on S. 2186. The following comments respond to the questions developed by your review of the testimony and outlined in your letter of February thirteenth. I trust that they will further clarify the American Mining Congress position on the legislation.

1. Under Title III of the 1977 Act, we believe that too many colleges and universities jumped on the bandwagon purely to obtain federal funds otherwise unavailable to them. S. 2186 provides stricter eligibility requirements and would limit the number of schools funded.

2. The eligibility criteria in S. 2186 is considerably narrower than the 1977 Act. The proposed Swisher amendment would broaden eligibility criteria and allow Institutes to remain in the program that are of questionable value. The American Mining Congress supports S. 2186 as drafted and does not endorse the proposed amendment.

3. The eligibility criteria inherent in S. 2186 should lead to a modest reduction in the number of eligible Institutes.

4. The only schools in opposition to the eligibility criteria as set forth in S. 2186

of whom we are aware are Southern Illinois University and the University of Kentucky.

5. The Committee created by Section 9 of S. 2186 would be qualified to develop a national plan for research and development in mining and mineral resources. No other committee composition can bring together the diverse points of view that must be considered in the development of such a plan.

6. The American Mining Congress does not disagree with the addition of an environmental representative to the advisory committee, provided that the person has expertise in mining research and development. It does not recommend the addition of a working miner or a native American; the committee functions in an advisory capacity and representatives from these groups would have no expertise to lend to the group.

Please let me know if I can be of further assistance in this matter.

Sincerely,

J. E. Thompson

JET:vmc

APPENDIX II

Additional Material Submitted for the Record

PREPARED STATEMENT

TO THE U.S. SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

S. 2186

My name is Dr. Donald A. Dahlstrom. I am Senior Vice President, Research and Development, of the Eimco Process Equipment Company in Salt Lake City, Utah. I am also the immediate past chairman of the Advisory Committee of the Mining and Mineral Resource Research Institutes for the past two years and have been a member of the Committee for approximately four years. I am also a member of the National Academy of Engineering, a past vice president and director of the American Institute of Mining, Metallurgical and Petroleum Engineers, a member of the Mining and Minerals Education Committee of the American Mining Congress and a member of the Chemical and Process Engineering Division Subcommittee of the National Science Foundation.

May I first indicate my complete support of the Bill because of the critical needs of our universities involved in the teaching and research in mining and processing of minerals and coal. This is in addition to the needs of our country and these industries that this Bill should be passed. The funds represented by this Bill are sorely needed by these universities to carry on the quality education and training of students in disciplines indicated in the Bill, as well as conduct the essential research. The latter serves two functions:

1. To perform the necessary basic research so vitally needed in mining and mineral and coal processing.

2. To train students in exploration, mining and processing so that they can go on to produce effective results and improvements in these industries after graduation.

Our country needs a strong mining, mineral and coal industry for its sustenance. The products of very useful minerals, metals and energy are essential to our economy and the needs of our citizens.

Simultaneously, these industries face the fact of seriously declining domestic ore grades in minerals compared to many other countries, as well as appreciably higher costs for professional and operating labor, environmental control and transportation as examples. As they must compete on a worldwide basis, with essentially common worldwide prices for many of their products, research to increase productivity, innovation and lower cost methods are essential to their vitality. Thus, universities have a dual role in supplying the highly talented professionals for this critical effort as well as the basic research needs to support vital improvements in mining and processing.

In my own experience on the Advisory Committee, I have seen the performance of these 31 institutes grow in quality. Additionally, we have been able to maintain and in some cases increase the faculty at universities. However, I would immediately point out that some universities are having to look for qualified faculty in other countries to satisfy quality requirements. This further strengthens the need for this Bill so that a source of good domestic graduate school products will be available.

The amount of graduate research has been increased by this program, while at the same time, opportunities for funding from the National Science Foundation and the Bureau of Mines has decreased. Furthermore, some of the funds made available under this program have been used for new faculty to assist them in getting started in research with "seed money" so that their ideas could be developed far enough to permit greater funding later on with more proven potential.

Funds have also been used to support both undergraduate and graduate scholarships and fellowships to augment that supplied by industry and other sources. Thus, students have been supported who otherwise would not have been able to enter this important career.

Five generic Centers of Excellence have been started at six universities with participation by several "satelite" Institutes to bring the best and proven talent to this effort. The five centers are:

1. Comminution - University of Utah
2. Mine Systems Design and Ground Control
   Virginia Polytechnic University
3. Respirable Dust - Pennsylvania State and West
   Virginia Universities
4. Pyrometallurgy - University of Missouri, Rolla
5. Mineral Industry Waste Treatment and Recovery
   University of Nevada, Reno

Thirteen other Institutes are supporting these centers with research programs.

While progress had definitely occurred under the previous legislation, it is imperative that S. 2186 pass. Otherwise, the Institutes will die. This would be a disservice to our country.

The present Bill does several things I feel are important.

1. Supplies allotment money to all Institutes
2. Applies research funding to the Institute program
3. Increases the matching fund requirement from states and industry from 1 to 1 to 1½ to 1 and later on to 2 to 1.
4. Increases the responsibilities of the Advisory Committee as well as its representation from Federal and State governments, the universities and industry. This will ensure a still more responsive program as well as increase cooperation between these entities.

In closing, let me comment on the alternative to S. 2186. This would mean that the Institutes would go out of existence in light of the legislation under which they are now operating.

From what I know of the dependency of these universities for allotments and research funding, teaching and training of students in these disciplines would suffer very rapidly. Funds would not be available for the next academic year from allotments for fellowships, needed equipment and initiating research monies for any new faculty. Thus, faculty and student incentives are immediately decreased.

Secondly, the immediate elimination of research grant funds would seriously reduce this vital work with little hope of increases in the future. Thus, not only is this going to critically reduce funds for needed basic research but impair the training of graduate students capable of the future innovations and creativity needed by these undustries. Furthermore, diversified research, supplied by 31 Institutes are critical to the training of students and to the needs of our mining, coal and mineral states for their economies.

Let me give one example of the contribution these Institutes can make. In the Center of Excellence in my own state at the University of Utah, they have an outstanding program on comminution with which I am well acquainted. In the United States, an excellent study on "Comminution and Energy Consumption", under the auspices of the National Materials Advisory Board, the National Academy of Science and the National Academy of Engineering, was completed in 1981. From documentation, it was pointed out that 1.3 percent of the total electrical energy generated in the Unites States was used for comminution, over 90 percent of which was in the mineral and coal industries.

I am very confident that this Center will definitely contribute significantly to the reduction of that enormous energy consumption.

The other alternative to S.2186 of letting these Institues die is unthinkable to me. I strongly recommend, instead, its passage.

THE NAVAJO NATION
WINDOW ROCK, NAVAJO NATION (ARIZONA) 86515

PETERSON ZAH
CHAIRMAN, NAVAJO TRIBAL COUNCIL

EDWARD T. BEGAY
VICE CHAIRMAN, NAVAJO TRIBAL COUNCIL

February 15, 1984

John W. Warner, Chairman
Senate Subcommittee on Energy
and Mineral Resources
SR-421 Russell Office Building
Washington, D. C. 20510

Dear Senator Warner:

Enclosed are our comments to S. 2186, which we understand would authorize and extend the current Surface Mining Control and Reclamation Act. We support the re-authorization of SMCRA.

We hope our comments will assist you. If you desire additional assistance, please do not hesitate to telephone me at (202) 775-0393.

Thank you for your time and action.

Sincerely,

Rodger J. Boyd, Director
Navajo Nation Washington Office
1725 K Street, N.W., Suite 703
Washington, D. C. 20006

/ab

Enclosures

TESTIMONY TO S. 2186

to Establish a State Mining and Mineral Resource Research Institude Programs and for other Programs

Since the passage of the Surface Mining Control and Reclamation Act (SMCRA) of 1977, P.L. 95-87, the Indian Tribes have clearly expressed their views on the administration and implementation of the control and reclamation of surface mining on Indian lands to the Secretary of Interior and in public hearing before Congress. Throughout this participation the Tribes have consistently expressed their strong support for legislation recognizing Tribal regulatory authority in the SMCRA of 1977.

Due to the unique jurisdictional status of Indian and the federal/tribal trust relationship, there is a clear need for federal legislation to regulate surface mining and reclamation activites on Indian lands. The enactment of the Title III legislation, as well as the Section 710 legislation, will be consistent with existing federal laws relating to tribal sovereignty, tribal self-determination and the unique jurisdictional status of Indian lands. The proposed Section 710 legislation under SMCRA should provide Indian Tribes with the same authorization as was provided to the states in Title III of P.L. 95-87.

By Navajo Tribal Council Resolution CJY-87-68 and CN-95-68 the Navajo Tribal Council established and chartered the Navajo Community College as the higher education institution of the Navajo Nation. The College has a record of real accomplishments in providing education, research and services to the Navajo people.

Indian Tribes should be eligible to participate in the same manner as States in the Mining and Mineral Resources and Research Institutes program established under Title III of P.L. 95-87. Full Federal funding should be made available to Indian Tribes to establish and maintain Tribal institutes to further the purposes of S. 2186 by enhancing the capabilities of Tribal members in those disciplines related to the regulation of surface mining and reclamation operations. To accomplish this Section 1 through Section 9 should be amended to insert Tribes/States throughout the legislation.

APPROPRIATIONS: Section 1 of S. 2186 should provide that the Tribes shall be considered as States for the purpose of assisting the Tribes in developing and administering tribal educational/research programs. The appropriations should be for 100 percent of the total program cost. Tribally sponsored colleges, such as Navajo Community College should be declared to be eligible colleges under S. 2186.

In practice, very little appropriations are made available to stripmine reclamation in the Southwest. Such research, investigations, demonstrations, experiments, and in an ecologically fragile environment for mineral reclamation requires additional appropriations.

ELIGIBILITY UNDER SECTION 10: The Navajo Nation cannot support the proposed eligibility criteria currently proposed under Section 10. As drafted the eligibility criteria will shut out institutions presently serving the local Indian research and educational needs. The Navajo Nation recommends withdrawal of Section 10, S. 2186 and use of the current language contained in Title III of SMCRA.

COMMITTEE ROLES, SECTION 2: This provision of the bill essentially allows the committee to play a more prominent role in recommendations to the Secretary. The question arises, what are the duties of the Secretary upon submittal of recommendations by the Committee? In Section 302 in SMCRA of 1977, the Secretary's responsibility is discrete, we request a redraft to the paragraphs to make the Secretary's duties as clear as possible.

COMMITTEE MEMBERSHIP: The Committee established pursuant to Section 9 should include at least two representatives of coal-producing Indian Tribes.

NATIONAL PLAN: The Navajo Tribe requests participation in the development of a "National Plan" for research and development in minning and mineral resources.

Finally, we support the need to extend the current SMCRA authorization, which expires in fiscal year 1984.

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OSU

The Ohio State University

Mining and Mineral Resources Research Institute

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140 W. 19th Ave.
Columbus, Ohio 43210

Phone 614 422-3837

March 2, 1984

The Honorable John W. Warner, Chairman
U.S. Senate
Energy and Mineral Resources Subcommittee
of the Energy and Natural Resources Committee
SD-308 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Senator Warner:

I am writing to ask your support of the proposed amendment to S.2186 which would change the eligibility requirement in Section 10. As one of 15 Institutes nationwide which do not have accredited programs in mining or minerals extraction, we would respectfully submit that our eligibility should be determined by our proven ability to perform vital research and training related to the needs of our State, region, and Nation and not by some arbitrary criterion which only in part measures this ability.

Our Mining Engineering program has not yet regained its accreditation since its' reinstatement in 1978 following a 12-year hiatus. The process of rebuilding a sound program has been slow despite the considerable assistance of the Mineral Institute support provided for the past five years. We have, however, built a program of high quality with graduates already serving with distinction in several segments of the industry. The process of obtaining accreditation has been even slower, but we expect favorable action from ABET next year. This accreditation process would, in fact, be hampered by loss of Mineral Institute support.

Meanwhile, we have provided important research for the Ohio and national mineral industry and have trained engineers not only in mining, but in other minerals-related disciplines. Two examples will serve to illustrate the importance of this contribution. The Ohio Mining and Mineral Resources Research Institute has provided support for a great deal of research into environmentally sound consumption of high-sulfur Ohio coal. This has included research into methods of sulfur removal before burning which presently appear to be the most economical alternative to either scrubbers or shipping in low-sulfur coal from out of state and into combustion techniques which would permit sulfur removal during combustion. Other research of local importance has included improved land reclamation and water treatment methods.

College of Engineering

The second example, in the area of training, is that Institute money has provided support not only for training mining engineers presently at work in Ohio's important coal mining industry, but for training ceramic engineers to support Ohio's large and important glass and ceramic industry. OSU is one of only a few ceramic engineering programs. Of course, Engineers and scientists have been trained in several other fields as well.

It is the purpose of the bill to provide for training of mineral engineers and scientists, not just mining engineers, and to provide research in various areas with "due regard....to the varying conditions and needs of the respective states." Only an Ohio Institute can meet Ohio's needs. Our ability to meet those needs is in no way related to our accreditation (or lack thereof) in Mining Engineering. Our record of accomplishment over the past five years without such accreditation certainly supports this contention.

We hope that you will support this amendment which will permit fourteen other Institutes and ours to continue to serve their States as we try to serve Ohio.

Sincerely,

Robert G Lundquist

Robert G. Lundquist
Associate Director

RGL/lh